IN THIS ISSUE:—THE SO-CALLED OPEN AIR SCHOOL

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THE HEATING AND VENTILATING MAGAZINE

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NEW YORK, MARCH, 1911

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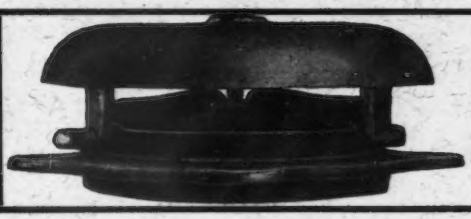

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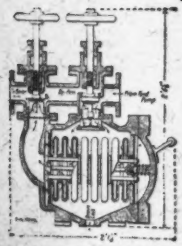

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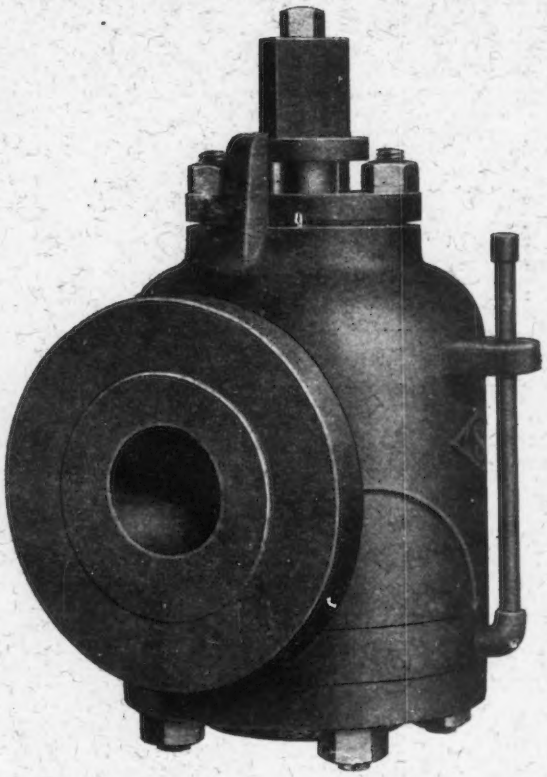

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK MARCH, 1911

Heating Requirements in New York Weather

BY REGINALD PELHAM BOLTON

EDITOR'S NOTE.—*An analysis of the weather conditions actually prevailing during the heating season in a city like New York may be made a very useful guide in determining the heating requirements, both for the whole period and for any given portion of the period. Such an analysis has been made by Mr. R. P. Bolton and is contained in a paper read before the Association of Edison Illuminating Companies, at its recent meeting, on the subject of "The Heating Problem In Its Relation to Central Station Lighting and Power Service." As a rule, the papers read before this body are not available to the public but, as the result of an exception made in this instance, we are enabled to present those portions of it which deal more directly with the subject of heating requirements in a climate like that of New York City.*

Under the climatic conditions of the middle and northern latitudes of this country, the artificial heating of buildings, during a portion of the year ranging in extent from 44% to 77% of the total time, becomes a necessary condition to their occupancy. The thermal requirements in the City of New York are not extreme, but are, by reason of its position at the seaboard, very variable both as regards temperature and humidity, wind and sunshine.

Although there has been in existence during the past thirty years a public company affording a supply of steam from a system of street mains, the limited area covered by its operations has scarcely affected the general demand, and the vast majority of buildings, as in other cities of magnitude, are heated by independent apparatus of all descriptions, mainly utilizing the heat of coal.

In all buildings occupied by more than one tenant, the burden of providing for the maintenance of temperature of the whole structure falls upon the owner of the property, a liability which has become extended in buildings used for light manufacturing into a supply of live steam for the use of certain tenants, and the maintenance of a supply of heated water for sanitary purposes in business and office buildings as well as in apartments. The wasteful habits of tenants render these conveniences, which are comparatively small in themselves, matters of magnitude in some cases, and in all, a matter of some uncertainty.

Also the general tendency in the metropolis towards additional height in construction has led to an immense growth in the requirements for elevator service, involving the use of power in the majority of commercial and the larger residential buildings, and in the early stages of this development the use of electricity lagged behind that of other means of operation. From this cause there developed in the business section of the city a very general practice of combining the work of heating and the generation of hydraulic power, in high-pressure steam plants which,

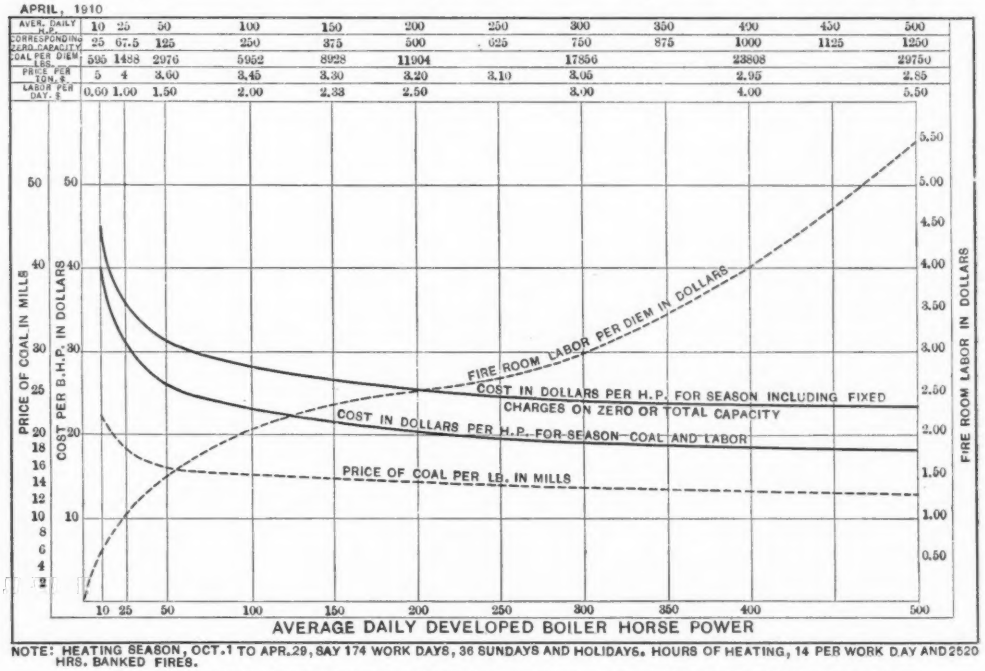
as the demand for electrical lighting increased, became extended into isolated electrical generating plants, manufacturing a supply of electricity for the convenience of the tenants.

It has naturally followed that such conveniences when produced upon the premises are included in rentals or offered as an inducement to prospective tenants, and the practice has so spread that it has now involved the owners of all kinds of buildings in the provision of gratuitous supplies of light and power, chiefly in the form of electricity and adapted to an increasing number of purposes in addition to the necessary provision of heat.

The general effect of the situation as above described, is unfavorable to the extension of central station electrical service, inasmuch as the heating of buildings involves the installation of some apparatus of a mechanical nature, and the employment of some labor for its operation, a condition of which those who are interested in the sale and operation of machinery for other purposes, naturally take advantage, in order to urge the installation of additional machinery, especially for the generation of electricity, combining the expenditure and labor upon the apparatus required for heating, with those involved in providing and operating generating machinery.

The almost universal practice of engineers and owners in New York City, is to use steam as the medium of the distribution of heat, and the problem of dealing with heating, therefore, limits itself to the supply of steam.

A certain demand exists in all sections of the city for steam at sufficient pressure for cooking and laundry purposes, which would seem to render it commercially desirable that any system of public supply should be one in which the pressure should not be less than 20 lbs. and possibly that already adopted by the New York Steam Company. Such a pressure would at first sight appear to be restricted to the application of a direct steam supply, and to preclude the possibility of the utilization of used or exhaust steam. This, however, is by no means necessarily the case, as there are central heating stations in operation, in which engines are operated on electrical service with a back-pressure of 35 lbs., and with arrangements, the details of which would occupy too much time herein to describe, but which would probably involve co-operation with the public


APRIL, 1910
AVER. DAILY H.P.
CORRESPONDING ZERO CAPACITY
COAL PER DIEM LBS.
PRICE PER TON, $
LABOR PER DAY, $
10 25 50 100 150 200 250 300 350 400 450 500
25 67.5 125 250 375 500 625 750 875 1000 1125 1250
595 1488 2976 5952 8928 11904 17856 23808 29750
5 4 3.60 3.45 3.30 3.20 3.10 3.05 2.95 2.85
0.60 1.00 1.50 2.00 2.33 2.50 3.00 4.00 5.50
PRICE OF COAL IN MILLS
COST PER B.H.P. IN DOLLARS
FIRE ROOM LABOR IN DOLLARS
FIRE ROOM LABOR PER DIEM IN DOLLARS
COST IN DOLLARS PER H.P. FOR SEASON INCLUDING FIXED CHARGES ON ZERO OR TOTAL CAPACITY
COST IN DOLLARS PER H.P. FOR SEASON—COAL AND LABOR
PRICE OF COAL PER LB. IN MILLS
AVERAGE DAILY DEVELOPED BOILER HORSE POWER

NOTE: HEATING SEASON, OCT. 1 TO APR. 29, SAY 174 WORK DAYS, 36 SUNDAYS AND HOLIDAYS. HOURS OF HEATING, 14 PER WORK DAY AND 2520 HRS. BANKED FIRES.

FIG. 1.—COST OF STEAM PER ONE B. H P. FOR THE HEATING SEASON, NEW YORK CITY CONDITIONS

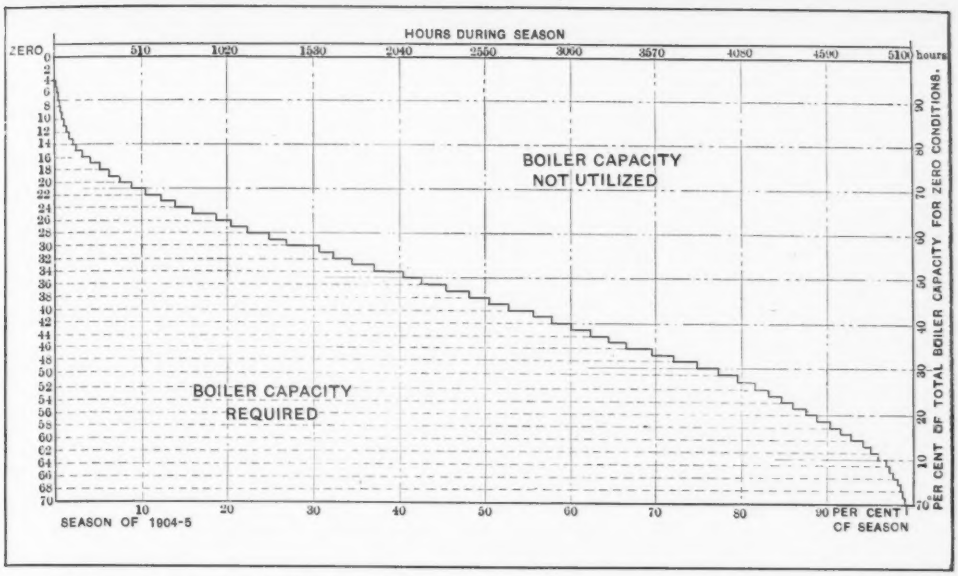


FIG. 2—PERCENTAGE OF BOILER CAPACITIES UTILIZED DURING HEATING SEASON IN NEW YORK

electric service, there is no reason why generating machinery should not be operated so as to emit used steam at even higher pressures.

The computed cost, in local installations, of a boiler horse-power for the heating season in New York City, is shown in Fig. 1, which illustrates the relative increase in cost in small installations, due partly to the quality of fuel required, to the absence of skilled labor and to the low chimneys usually to be found in small buildings. The efficiency of such apparatus is very low, and the cost of heating is excessive, amounting in steam-heated tenements to as much as one-tenth of the total gross earnings of the building.

Any domestic installation involves not only a considerable investment, but one the effective use of which is restricted, and in which during a large portion of its existence, the apparatus is actually idle, and furthermore, the climatic variations are such as to demand the installation of a capacity equal to dealing with the emergency of a zero temperature, a condition which, however, very rarely occurs in New York City.

The total use made of the capacity of heating plants under New York City conditions is illustrated by Fig. 2, in which are plotted the actual hours of the existence of various temperatures during the heating season of the year 1904-5. This diagram also indicates the relatively low load or rate of output at which heating apparatus must be operated for a large part of the period of its use, and the low efficiency which results from this feature, is one of the factors that go to render heating relatively expensive.

ASCERTAINMENT OF HEATING WORK

A very common practice among those who are interested in the installation of power machinery in buildings, is to exaggerate the requirements of heating, in order to bring about some ostensible relation between the exhaust of a power plant and that of the steam for heating purposes.

Such relation, in view of the comparative shortness of the heating season, as well as of its vagaries, cannot exist. The demands for power and light in a single building do not coincide with its heating requirements, though the aggregate heating of a number of buildings, many of which do not demand light or power, may approach closely to a co-ordination.

In the case of any ordinary building such results will be found as are shown in Fig. 3, which is the best observed condition as regards the utiliza-

tion of exhaust steam and is plotted from hourly steam and electric consumptions in a building where the heating demand is unusually large, due to mechanical ventilation. For other temperature conditons than those shown, a rise in the demand for steam for heating, while it would reduce the amount of exhausted steam going to waste at certain hours, would also increase the amount of live steam required to be injected into the system during the night and early morning hours. About the best result which may ordinarily be expected, is the utilization of about 60% of the exhaust for the purpose of heating during five of the heating months, or of somewhat less than 30% of the total annual use of steam.

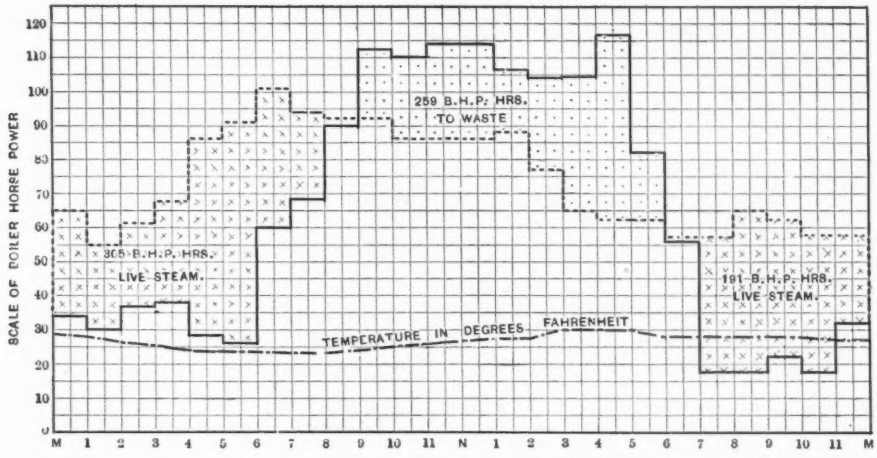
In view of such controversial matter as has thus entered into this subject, the work of exactly computing the variations in the heating requirement of buildings has become a matter of importance, and where competition between an isolated plant and the central station supply is to be considered, this matter must be reduced to a dependable basis and must be capable of analysis and comparison with the fluctuations of demands for light and power.

The common system of relating the work or cost of heating to the cubical contents of the building, is one which is liable to be misleading, and may lead to over or under estimation from causes that will be evident. The actual work of heating is not varied by the fact that the interior of the building is a certain size but it is directly varied by the exposure of the exterior of the building to outside temperatures and to wind effects.

The usual methods of computation applied to new buildings are based upon the ascertainment of exterior surfaces and their relative heat-transmitting values, with an addition thereto of a certain fixed allowance for cubical contents, on the ground that these contents represent approximately the amount of air leaking into the building from the exterior in one hour,—giving for one change of contents per hour:

$$\left\{\frac{W}{4} + G + \frac{C}{55}\right\} t = \text{heat losses in units.}$$

Where W = Wall surface exposed.
G = Glass surface exposed.
C = Cubic contents of interior space to be heated.



																							TOTALS
HRS. K.W.	17	15	18	19	14	13	30	34	45	56	55	57	57	53	52	54	58	41	28	9	9	11	9	16	770 K.W.
TO ENG. B.H.P.	34	30	36	38	28	26	60	68	90	112	110	114	114	106	104	108	116	82	56	18	18	22	18	32	1540 B.H.P.
ACTL. STEAM	65	55	62	67.5	86	92	101	94	92.5	92.5	89	86	86	88	77	65	62	62	57	57	65	62.5	57	57	1778 B.H.P.

Friday, March 5, 1909.
Clear, Sunshine, 100%.
Temperature, 23° F. min., 30° F. max., 26.4° F. mean.
Steam to engines=1540 B. H. P. hours.
Total steam 1778+259=2037 B. H. P. hours.
Total heating steam=1778 B. H. P. hours.
Exhaust to waste=259 B. H. P. hours.
Live steam to heating=496 B. H. P. hours.
Exhaust utilized=1281 B. H. P. hours.
63% of total. 83% of engine exhaust.

FIG. 3.—TYPICAL INSTANCE SHOWING RELATION OF ELECTRIC LOAD TO STEAM
Actual Electric Load at Rate of 2 B.H.P. per Kilowatt Hour.

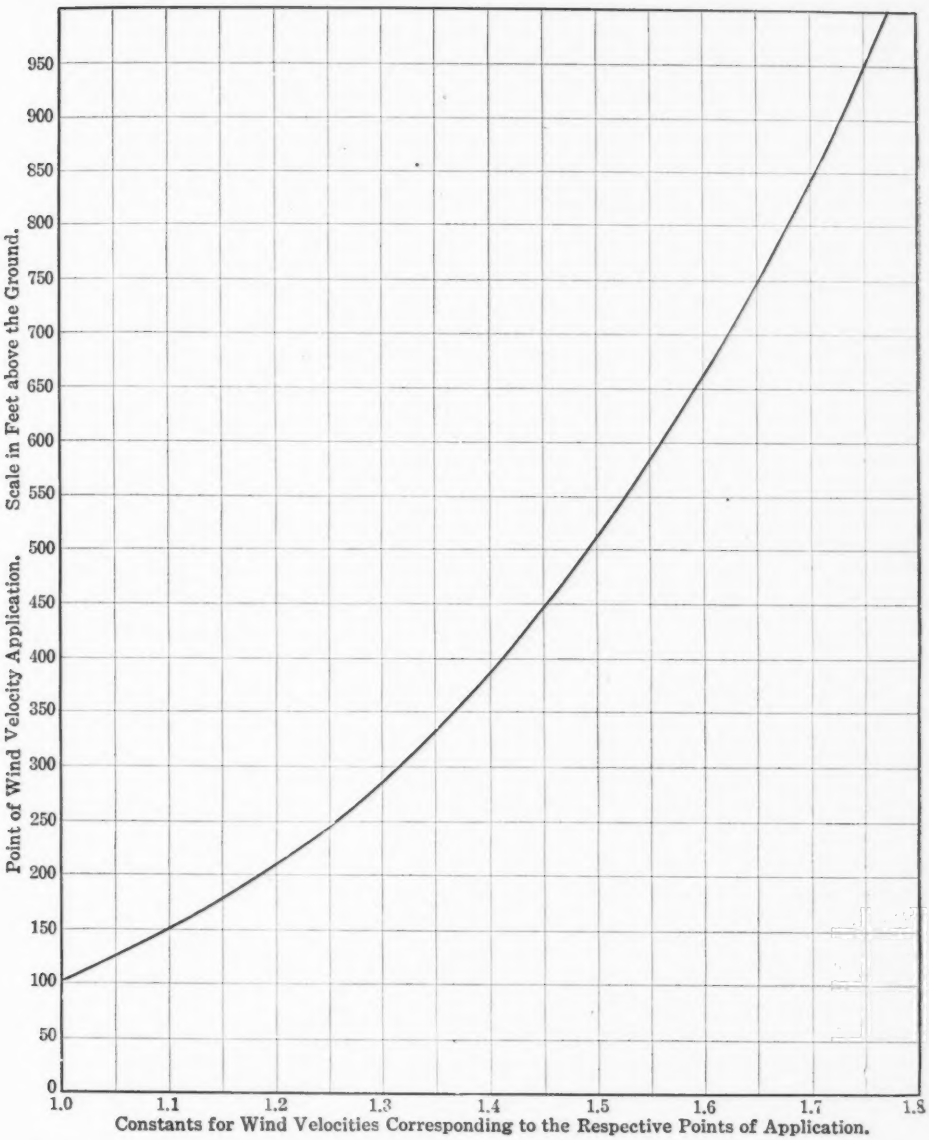


FIG. 4.—INCREASE OF WIND VELOCITY AND CORRESPONDING PRESSURE DUE TO HEIGHT OF BUILDINGS

t = Temperature difference between exterior and interior.

While the losses of heat from the exterior of a building are by this method fairly ascertainable, the loss by infiltration is empirical, and this item becomes of considerably increased importance as buildings are increased in height. Methods of building construction, while they have been largely improved in a general way, have not relatively improved in the matter of the construction and setting of window-frames, and in high and unprotected buildings, the loss of heat due to this cause is quite a substantial element in computations of this nature.

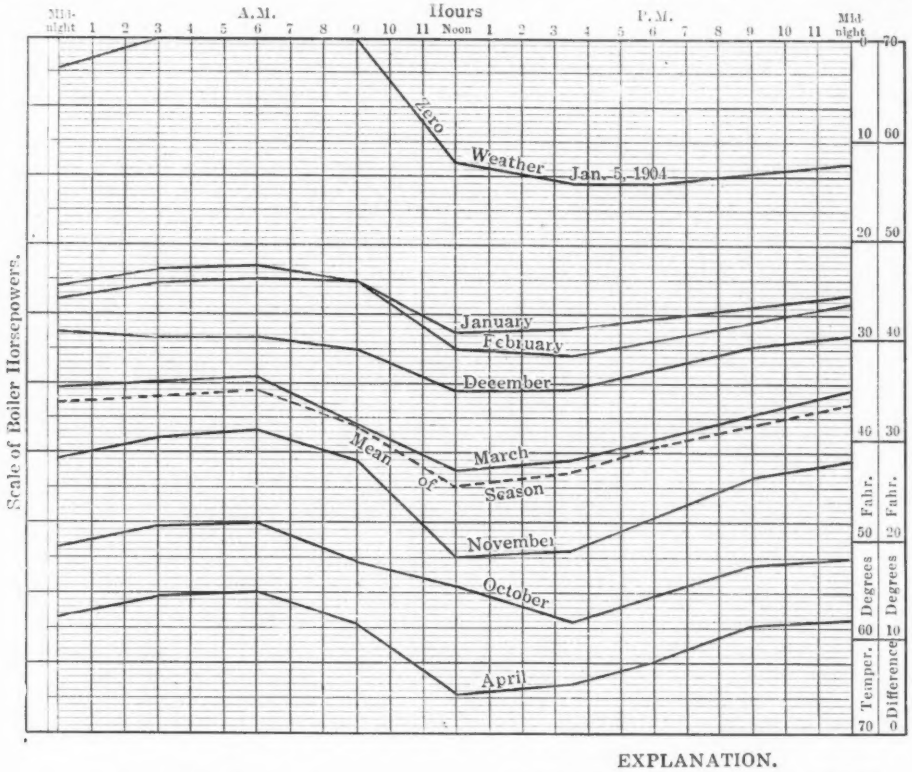
The increase of wind velocity and corresponding pressure due to height, is shown in Fig. 4, by which it will be seen that any opening or leakage point situated at a considerable height above the ground, must be regarded as of greater extent or capacity for leakage than one which is below the average level of buildings in the immediate neighborhood.

Another element which contributes to this result is the funnel or chimney effect of tall buildings which establishes, under certain conditions of wind, a strong draft through the corridors and elevator hoist-ways, thereby drawing away heat from the lower portion of the building. On account of this effect it has been found necessary in certain tall buildings, to add heating surface to the lower floors, in excess of computed requirements.

The theoretical method which has been followed by the writer, of ascertaining the heating work of the season for any building, has given very close approximations to actual results, and it may be of sufficient interest to describe herein.

An examination of the recorded variations of temperature for thirty years past has afforded the means of plotting the average hourly variations for each month of the heating season, bringing out the fact that the night temperatures are generally lower than the day temperatures, and that the work required for heating is always relatively lower at the period of maximum day work.

The diagram shown in Fig. 5 is used for the ascertainment of these average hourly conditions, the temperature curves being inverted and becoming a



EXPLANATION.

The curves are the averages of the hourly variations of temperature and represent conditions of the Season of 1903 - 1904 which was a representative Heating Season closely following the average of thirty years observations in New York City.

By ascertaining the maximum heating requirements, at Zero, of any building, the vertical scale at the left can be used for Boiler horsepowers, from which the average requirments during any month, and for any hour of day or night can be read off on the scale.

Division of the Heating Season, New York City.

Month	Days	Holi-days	Sun-days	Work-days
October	16	—	2.20	13.78
November	30	2	4.20	23.70
December	31	1	4.40	25.57
January	31	1	4.40	25.57
February	28.25	2	4.00	22.25
March	31	—	4.40	26.57
April	15	—	2.14	12.80
Totals	182.25	6	25.92	150.30

FIG. 5.—HOURLY VARIATIONS OF HEATING WORK IN NEW YORK CITY AND VICINITY

relative scale of boiler horse-power, so that the average proportion of heating required at any particular part of the day in any month of the season can be rapidly ascertained. These curves are based upon the recorded conditions of the heating season of 1903-4, which were found to be very close to the general average of thirty years prior to the year 1907.

It will be seen that the maximum observed heating work which is that at the top of the diagram, on the rare occurrence of a zero temperature, falls off after the day hours, and, as has been already noted, on only about eight days of the heating season, or less than 4% of the heaing period, is there any temperature approaching the neighborhood of 0° F.

In time gone by, a temperature of zero was more frequently recorded, and as it is frequently reached in the vicinity of this city, it seems probable that the general temperature of the borough may be raised by the heat emitted from the numerous heating plants in the closely built-up center of the city.

WIND EFFECTS

The effect of wind in increasing the results of low temperature has been made the subject of separate study. Combinations of high velocity and low temperature have been searched for, over the records of many years, and the most severe heating combination found has been that of a wind-speed of 42 ft. per second accompanied by a temperature of 20° F., which combination occurred on January 1, 1904, and would represent for an exposed and lofty building a condition somewhat in excess of a zero temperature in a still atmosphere. The combination is therefore adopted of a zero temperature with this wind speed in order to arrive at the suitable amount of heating surface on exposed windowed sides of any building.

The average wind movement for a month may then be utilized with effect in a computation of heating work, notwithstanding the variations of movement and direction, and the system of proportioning heating surface to meet wind effect from any point of the compass, eliminates dependence upon common methods of adding empirical amounts, such as 10% to 35% to heating surfaces on the north or other side of a building.

The effect of wind is mainly found to be in the leakage of cold air around the window-framing, sashes and meeting rails, an effect increasing with height from the surface or general level of other protecting structures. The use of close metallic wind stripping to reduce leakage around window sashes has been the subject of much discussion, and of some investigation, and in the recent experiments of Mr. H. W. Whitten, the writer had the interest of taking some part. By mounting a small room on a pivot upon the roof of the West Street building, the opening in which room was alternately provided with various forms of window construction it was possible to test the amount of air passing through the sash at various speeds and pressures of wind. The general result of this and other investigations on the subject is to indicate that the excellence or poverty of construction of window frames and sashes may affect the total heating work to be done in a building, by as much as 15%, but that the natural ventilation of occupied spaces may be almost entirely precluded by close metallic weather stripping of window sashes.

From these observations the conclusion is derived that the work of heating buildings closely follows variations of temperature, modified by the variations in wind velocity, the effect of this latter being dependent upon the number of windows and their construction, but being in all cases in the direction of an increase of the heat to be provided. This is found to be the case not only in a single exposed building, but in a large number of buildings grouped together. Thus, the Crawfordsville, Ind., (hot water) district heating plant, has an established practice of a reduction of the temperature of the hot-water supply of one degree per degree rise of temperature above zero, or an addition of 2 degrees per 1 degree fall below zero, but these modifications

are varied by the addition of one degree for each mile per hour of wind velocity.

The district heating system of the Columbus Railway and Light Company also follows the same general practice with success, varying the amount of hot water pumped through the mains, as well as the initial temperature in order to meet rise and fall in temperature with modifications to meet the velocity of the wind.

The study of wind effect has indicated that the heat transmitted through the building materials, due to the action of convection, is not materially enhanced by the movement of the air, because the action of convection in still air is always to establish a vertical current of heated air rising around the building, and the action of wind merely translates this vertical motion into a horizontal movement, at the same time creating on the lee side or sides a negative condition, reducing the motion due to convection and stagnating its action.

The method of defining the heat losses of any building which combines the elements of temperature and wind-infiltration is therefore, for 0° F. exterior and 70° inside temperature.

1. Transmission losses.

   W = exterior exposed wall surface in sq. ft. x 21 = heat units per hour.

   G = area in sq. ft. of window openings x 70 = heat in units per hour.

2. Leakage to be heated from all sides of building.

   L = perimeter of window openings in feet for ordinary construction x 72 = heat units per hour.

   = perimeter of window openings in feet for metallic stripped sashes x 31 = heat units per hour.

The sum of all in heat units, plus 15% for line and pipe losses, divided by 30,000 = Boiler H. P. required per hour to meet the most extreme weather conditions.

This total capacity placed on top of Fig. 5 gives a scale by means of which all monthly hourly averages and totals may be ascertained.

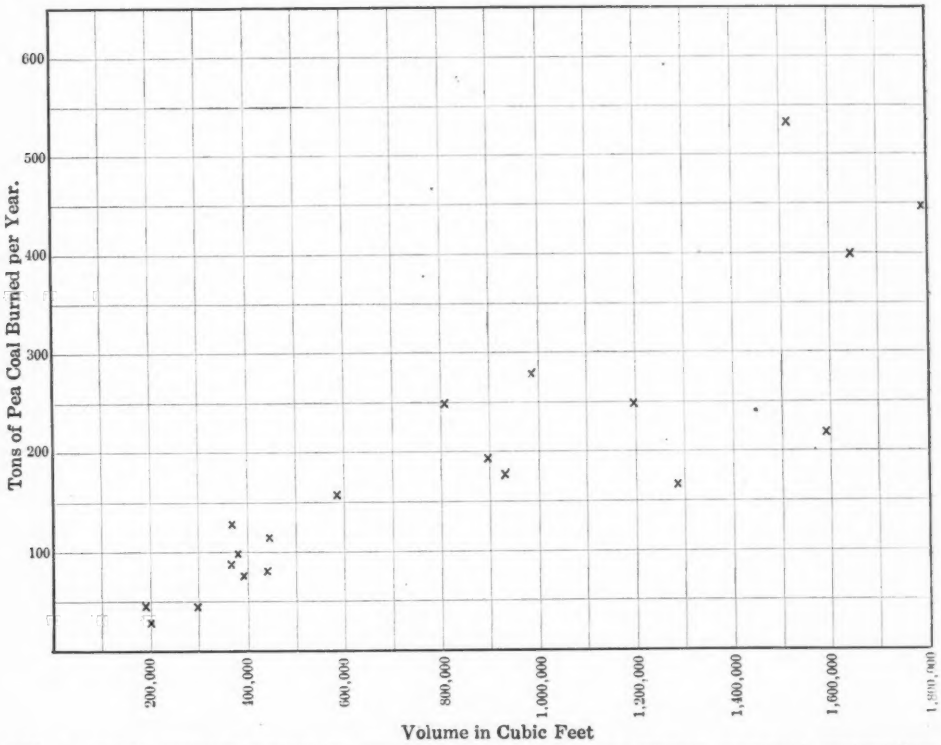


FIG. 6.—COAL CONSUMPTION IN BUILDINGS RELATED TO THEIR CUBICAL CONTENTS

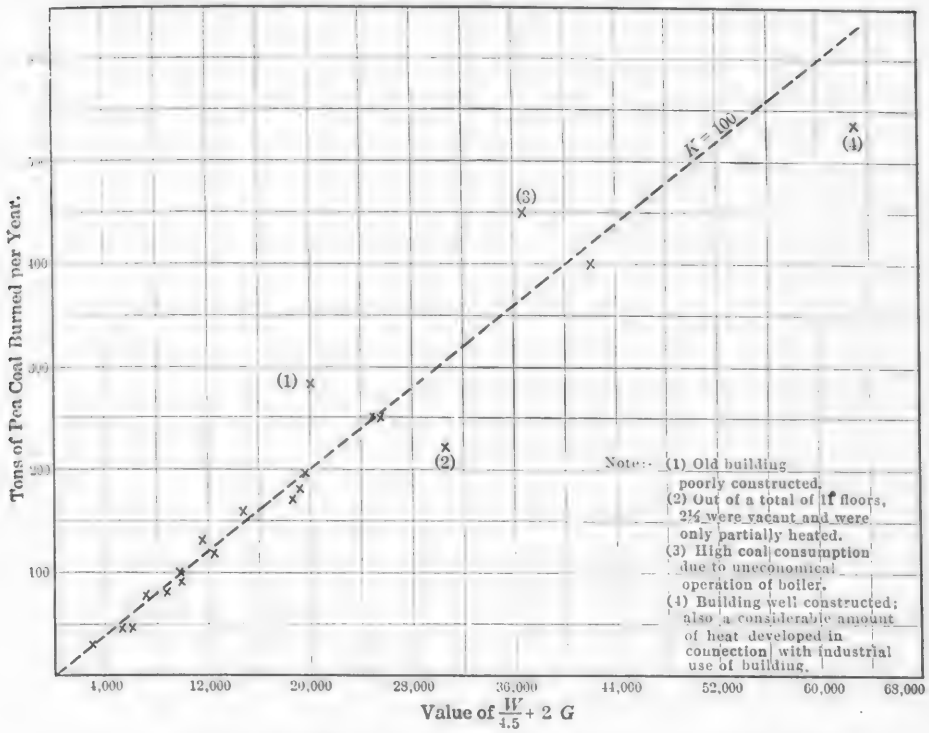


FIG. 7.—COAL CONSUMPTION IN BUILDINGS RELATED TO THEIR CUBICAL CONTENTS AND EXPOSURE

As the lineal feet in the perimeters of window openings, plus the meeting rail, is in standard types of windows equal to the amount of the area of the opening in square feet, the computation of wind leakage may be simplified by treating L as G reducing the computation to G x 70 + G x 72.

The methods above outlined, have been interestingly confirmed by observations conducted by Mr. E. F. Tweedy, of the New York Edison Company, the results of whose investigations are shown in the accompanying diagrams—Figs. 6 and 7. On No. 6 are plotted the actual consumptions of coal of a number of buildings related to a basis of their cubical contents. It will be observed that the plottings show no definite relation to one another, and that the rate of coal consumption per season per 1,000 cu. ft. appears to be same in the case of buildings widely differing in total cubical contents.

The same cases show an harmonious relation when plotted as in Fig. 7, on a basis which takes into consideration the exposures of the buildings, with due allowance for air leakage.

The observations and deductions therefrom are thus described by their author:

"Being confronted with the necessity of being able to predict with a fair degree of accuracy what the amount of coal required to heat a given building would be, I determined to secure actual coal consumption figures for a large number of buildings of different types in this city to find some relation between these coal consumptions and such physical characteristics of the buildings are are generally known to affect the heat losses. As my purpose was to obtain a relation to which the average building would conform, it was necessary to make certain assumptions, as will be evident from what follows:

"At the outset, it was necessary to adopt an average ratio for the rate of heat transmission of glass to that of wall surface, and to obtain this it was, of course, necessary to adopt some thickness of wall as representing a fair average for loft and office building construction in this city. Without entering into the details which led up to

its adoption, I will say that a ratio of 4½ to 1 was finally adopted.

"Realizing the uncertainty which arises in providing for the leakage loss on the basis of assuming an arbitrary number of air changes per hour, I decided to combine this loss with the transmission losses. Such a combination was deemed possible by the following line of reasoning: the leakage loss being proportional to the summation of the window perimeters (assuming the leakage space to be approximately constant in width), and the sizes of windows in similar types of buildings being fairly uniform, it becomes possible to consider the leakage loss as a function of the total glass surface without any very appreciable error.

"Having made the foregoing assumptions, the following equation is obtained:

$$T = \frac{1}{K}\left(\frac{W}{4.5} + G\right) + \frac{1}{K'}G$$

Where T = tons of coal consumed per year.
W = total exposed wall surface in sq. ft.
G = total glass surface in sq. ft.
K & K′ = Constants.

"As it is not necessary to solve the above equation, K and K′ need not be actually determined; for purposes of plotting, however, a relation between K and K′ must be obtained. For K = K′ the equation evidently becomes

$$T = \frac{1}{K}\left(\frac{4.5}{W} + 2\,G\right)$$

"The relation between K and K′ can be varied considerably without affecting the results to any appreciable extent, other than to alter the value of K. For K = K′, K = 100, which is a very convenient quantity for practical use. Fig. 7 shows 20 office and loft buildings plotted from the equation in the above form, and it will be seen that the values conform very closely to the equation as given. It will be observed that pea coal was burned in all of the buildings cited. Data was secured, however, on a number of buildings where the buckwheat coals or various mixtures were being used. All such cases—as would naturally be expected, due to the lower calorific value of such fuels—fall above the pea coal line, but in most cases to a considerably greater extent than is to be explained by the difference in the thermal value of the fuels. I think that this can be accounted for by the fact that these poorer coals are very rarely burned under proper conditions as regards type of grate and draft, thereby nullifying the saving which might otherwise result from the use of a cheaper fuel.

"For apartment house buildings, the same general relation has been found to hold good, the only difference being that the value of the constant, K, is less, being about 60 instead of 100. This can doubtless be explained by the generally poorer construction of such buildings and by the fact that heating is required for more hours during the day."

For Better Air in Cleveland Schools

Principals and teachers have declared war on bad ventilation in the schools of Cleveland, Ohio. Rules providing for pure air in the school rooms and good ventilation in the halls and corridors of the school buildings were decided upon at a special meeting of the Principals' Round Table at Brownwell school auditorium.

Chief Medical Supervisor Sherman and all the teachers agreed that it was time to fight disease by means of pure air.

It was found upon discussion that on account of the heating systems of the schools proper ventilation could not be secured unless a different mode of precedure was adopted. It was voted to resort to concerted action in the window-opening proposition.

Periodically, at the sound of a gong, up go scores of windows. Then the gentle zephyrs of Lake Erie sweep through the rooms while the children are either exercising or in a safe retreat from catching pneumonia.

The So-Called Open-Air School

EFFECTS OBTAINED THROUGH LOWERING THE TEMPERATURE AND INCREASING THE HUMIDITY IN CLASS ROOMS

Perhaps no one in the country has had a better opportunity of judging the effects obtained through the so-called open-air schools than Dr. William E. Watt, principal of the Graham School in Chicago. In the various experiments he has conducted in his own school, the scholars have been placed in rooms with varying air conditions and the effect on the health of the pupils under each condition carefully noted. Some of the more important results obtained by Dr. Watt were detailed in a recent address he gave before the American School Hygiene Association in New York. Among other things, he said:

The term "open air" requires definition because there are now four sorts. In the Graham School are, at least, three varieties of open-air work as well as the important feature of humidifying and lowering the temperature of the closed rooms, and results vary with the degree of cold maintained, the degree of purity in the air, and the amount of bodily activity provided for in the course.

The first meaning of open air which suggests itself to the average mind is a place where the air is freely admitted to the school without any warming or humidifying and the pupils are bundled up in Eskimo fashion and supplied with food and foot-warmers. This may mean a rather expensive form of school and is not the form of open-air work which is to be found at the Graham school either in the kindergarten or in the eight grades above it.

Our kindergarten is one in which there is not a penny expended for materials not found in the ordinary kindergarten, except that a benevolent woman has supplied each child for some months with a two-ounce bottle of sterilized milk daily. The clothing worn is that which a child ordinarily wears in attending school. During sessions the children do not lay aside their wraps unless they find the room too warm for comfort. There is more bodily activity in our kindergarten than in others, and the circulation induced and the vitality secured cause the room to seem warm to the children when to an adult unused to open air it would seem chilly.

Little children generate much more heat than adults, and one of the results of our work in open air is the conviction that parents and kindergartners generally are mistaken in their ideas of the amount of wraps a little child needs and the temperature the room should have in which he is housed and taught.

EXPERIMENTS WITH TEMPERATURE UNDER 40° F.

During the year we have permitted the temperature at times to fall below 40° F. with a result truly surprising to those who have not seen open-air work done in cold weather. For a time we believed a temperature running down to 40° should be maintained whenever the weather will permit, that is, when the outside temperature is low enough to secure 40°.

But when I discovered that the kindergartners had procured for themselves felt slippers to protect their own feet on the cold floor, it occurred to me that as the children brought nothing extra, although they were younger and were producing more heat, it would look better to have the teachers dressed in no different costume from the ordinary, and so the temperature was raised to between 50 and 52°. This is the temperature now maintained in cold weather. Although the kindergartners preferred to have the colder room and the children seemed to like 40° better than 50°, we are keeping the temperature at 50° to 52° unless the weather forces it higher.

We tried lower temperatures than 40° with good results. Fearing the children might be enthusiastic or careless and not report when they were chilly or when their toes were cold, unusual care was taken by the teachers to make sure that none suffered in the cold. It is the belief of the two kindergartners in charge of the room that there is no danger from this score, for the children tell them freely when they are chilly or have cold feet, although the occasions are rare.

A temperature of 32° F. was maintained for awhile several times, the children positively enjoying the experiments and none suffering any discomfort. This temperature was not maintained for a full day at any time, but only for a short time as an experiment, the understanding being that the room should be warmed at once if desired and individuals might run into the warm corridor at any time, a privilege very few, I believe six, took once only.

ANIMAL HEAT HELPS VENTILATION

Animal heat is a factor in ventilation, especially in a room filled with children of kindergarten age. One of the most valuable results of our procedure is the discovery of a use for this heat in moving the vitiated air out of the breathing zone and letting pure air into that zone. Little children produce much more warmth than older persons. They dislike to be bundled up and wish to let nature have an opportunity to meet the conditions of natural air. They do not like a warm room after they have had some experience in a cool one with vital air.

There is a good reason why every well young child desires so strongly to get out into the cold to expose himself until his mother is frightened, and to revel in winds which cut his skin keenly and set his peripheral circulation into vigorous action. From observation of our kindergarten I am convinced it is healthful and invigorating for a child to expose himself more than is ordinarily permitted, a reasonable amount of caution being used, of course.

As the body naturally produces more warmth when exercised in open air, it is unnatural to have the exercise performed in warm, close air. It is also unnatural to prevent exercise by bundling the child up too much or by keeping him in a room so warm he is disinclined to exercise. I do not think the power of producing warmth is easily atrophied, but I know it is materially weakened in persons who year after year close the body away from outdoor air and keep it "protected" from any approach to inclemency.

In the cold room expired air and excrementitious gases rise directly and are crowded out of the windows at the top of the room by pure cold air entering it. This keeps the breathing zone pure, a thing distinctly new. Absolutely pure air in the breathing zone is had not only in the kindergarten, but in many other rooms where we have discontinued plenum.

WHERE THE VITIATED AIR GOES

Expired air has a high temperature. It is laden with carbon dioxide, which is 50% heavier than air at the same temperature. But there is but 4% of carbon dioxide in expired air. This does not weight it down to any great extent. In fact, expired air at a temperature of over 90° F., when set free in air under 65° is sure to rise. The colder the air in the room the more quickly will expired air rise to the ceiling. Consequently, if we had no other motive than to provide pure air in the breathing zone, we should put the temperature of our school rooms down to the freezing point.

Now let us consider what happens in air at the high temperature usual in kindergartens. Expired air at something over 90° thrown into the kindergarten where the air at the breathing zone is 70° or more, has little tendency to rise. It is slightly weighted down with carbon dioxide and its temperature is not much different from that of the room. Furthermore, in the upper part of a room heated to 70° or more the air is usually much warmer still; I have found 90° in t upper part of such a room.

Carbon dioxide will not rise in such air. It will float about or fall to the

floor. Its first action is to rise slightly a few inches in front of the pupil and then gravitate back into the breathing zone, carrying foul air with it, where it is breathed by some other pupil, sent up slightly, and then it falls to the nostrils of a third pupil. Consequently, in the warm, dry kindergarten disease germs in any one pair of lungs are imparted to every other pair of lungs in the room. This accounts for the absence from the ordinary kindergarten of a large part of the membership in the cold months, when the hot, dry conditions of the room militate against the health of the pupils.

By rebreathing the air diseases are spread so effectively that no child at an age when he is particularly susceptible can escape having colds and some of the children's diseases. They are called children's diseases, not because they are peculiar to children, but because children under seven years of age are so low in their power of resistance that they are usually afflicted with some of these ills.

Adults with low resisting powers contract "children's diseases" readily. Witness the red Indian in his struggles with the measles. Weakened by housing, which is deadly to the red man, he falls an easy prey to this simple disease, and deaths from measles are very common among adult Indians who are trying to imitate the white man's vicious way of housing himself.

We keep our kindergarten cool because we are able to separate the vitiated air from the pure humidified air without difficulty and keep the breathing zone absolutely pure all the time. I say this with deliberation: We keep the air in the breathing zone of our kindergarten pure. I am aware of the belief that there is no housing which affords pure air to its occupants, but I wish to announce that we have discovered a different form of housing and are applying it to education all along the line, from the kindergarten to the high school. Furthermore, the largest private military academy in the country, over which I have charge of the ventilation, is applying pure air in the breathing zone for all students up to the time of graduation as second lieutenant in the United States army or entrance at the university with advanced standing. Four universities are now in communication with me with a view to applying it within their walls. The only obstacle to the installation of pure air in all these universities is their doubt that pure humidified air can be given to the breathing zone. The truth is, it may be had in any sort of building by the application of the principles exemplified in the kindergarten and other rooms of the Graham school.

AS TO STATURE

The stature of the pupils who have been permitted to breathe natural air in school during the past year has made an interesting advance. This was reported to me by first grade teachers who are working in pure air and have pupils which were in cold air kindergarten last year. I regret I have been too busy to gather accurate data regarding this, as the matter forced itself upon my attention only this week. I am simply reporting the words of two open-air teachers in first grade when I state that there is a gratifying increase in stature in pupils who have had this advantage during the past year. The pupils are not becoming giants, as far as we are able to judge, but they have grown unusually well.

From the first grade we gather data which throw light on what has been done in the open-air kindergarten in the past year. The young son of a physician entered the first grade fresh air room because it was not considered safe for him to attend a regular school. He was to have been sent to the country for a year at his grandparents' farm, but instead the fresh air work was chosen. He is one of the most remarkably robust youngsters in the city today, and his father, Dr. Hagey, attributes his vitality to the fresh air work.

We have had no bad results from the cold air. The worst difficulty was experienced just before Christmas, when celebrating. A child's grand-

mother attended and got cold feet. We judge cold air is a little severe on grandmothers, who merely sit and do not get into the games.

EXPERT TESTIMONY

Dr. J. MacDonald, Jr., editor *American Journal of Surgery*, New York, inspected the Graham school last month and said, "I find evidences of more good red blood in this kindergarten than in any other kindergarten I have ever seen."

Dr. Woods Hutchinson has twice visited us and speaks with enthusiasm of the fresh air results.

Miss Henriett Roos, one of our kindergartners, says, "The children are much more alert than ordinarily housed kindergarten children. They learn songs in a week which used to take three in warm, dry air. Their hand work goes quicker. They do not need nearly as much direction. At first I thought it an unusually bright set of pupils, but find the new ones this year work better, or as well, as those in open air last year." Of the attendance, she reported that in cold weather, when the ordinary kindergarten is depleted by illness and fear of cold, but six or eight of the cold-air children are absent on the average. More children are probably in attendance there this cold morning than in any other kindergarten in Chicago.

RADIO ENERGY RIVALS OXYGEN

A year ago I earnestly asked the members of this society to tell me the reason that pupils in open rooms improve physically so rapidly. I thought it could not be due entirely to the better air. The best reply I received was that window glass shuts out the ultra violet rays of light, which have much to do with vitality. At the time I was asking this question, Professor Rutherford, of McGill University, was declaring in another convention that the action of radium emanations in the atmosphere must have a profound physiological effect, the data of which we are entirely ignorant of at the present time.

I think he had my answer and I the facts he was wishing for. The new science which Mme. Curie has given to the world seems to prove that the air is animated with supremely fine oscillations, which come from the escape of emanations of radium from the earth. The gases which compose the atmosphere are ionized by these emanations. When such air is breathed we find it is a great stimulant to healthy activity and resistance to disease.

The physiological effects of radioactivity and the X-ray are practically the same, as are also those of the ultra violet rays. Now, in our fresh-air kindergarten and fresh-air rooms of the Graham school, we are applying radioactivity in the very place where other schools apply dead air with fatal or crippling results.

We are giving our pupils a safe wireless X-ray treatment from within. This stimulates the tissues and weakens the bacteria.

Air that is heated loses its radioactivity. Air that is perfectly correct in its component parts may be dead, devitalized and unable to afford vital energy. We can live in it, but at a poor dying rate. I attribute the splendid physical and mental condition of our open-air pupils more to the beneficent energizing of radioactive air than to the purity of the air in our open rooms.

A Nebraska Hygienic Programme

Following is the health programme recently proposed by the Nebraska Association of School Principals and Superintendents:

Compulsory installation in school houses of ventilating heating plants.

Compulsory cleaning and disinfecting of school houses at least twice a year.

Compulsory submission of all school house plans to a state architect for approval.

Compulsory medical inspection of school children.

Compulsory medical inspection of all school teachers.

"So far as people's health is concerned," comments the Lincoln (Neb.) Journal, we are scudding into socialism at the speed of a gale." At the same time it approves the proposition.

Ventilation of the Capitol, Washington, D. C.*

A CASE OF FAULTY DISTRIBUTION WITH AN UP-DRAFT SYSTEM

By Nelson S. Thompson

In accordance with the request of Prof. James D. Hoffman, I take pleasure in presenting the following report of Passed Assistant Surgeon Norman Roberts, Hygienic Laboratory, United States Public Health and Marine Hospital Service, on the ventilation of the Capitol, Washington, D. C., with some comments thereon by Mr. H. C. Russell, a candidate for membership of the society, and a brief description of the apparatus to be used by the office of the Supervising Architects, Treasury Department, in determining the purity of the air in buildings under its control.

The following is the report of Dr. Roberts:

"In this examination there were made one qualitative test for sulphur compounds, one for carbon monoxide, four quantitative determinations of ammonia, and forty-two of carbon dioxide.

"The test for sulphur compounds indicated their presence, but in such small quantity as not to justify the very considerable labor of determining the exact amount present. Sulphur compounds, mainly the dioxide, are present in greater or less amount in the air of all large cities, or in general wherever coal is being burned in any considerable quantity within a number of miles to the windward, but are of no hygienic significance unless in considerable concentration.

"The test for carbon monoxide (furnace gas and illuminating gas) was negative.

"The determinations of ammonia resulted as follows:

		Grams per Cubic Meter.
House Floor,	(1).....	0.00037
	(2).....	0.00038
Senate Floor,	(1).....	0.00041
	(2).....	0.00031

"These amounts of ammonia are without significance under the circumstances.

"The determinations of carbon dioxide are given on the following page in the order in which they were made.

"The permissible limit of carbon dioxide in the air has been somewhat arbitrarily fixed at 20 parts per 100,000 *above* the amount in the outdoor air, i. e., the amount of *respiratory* carbon dioxide must not exceed 0.0002. Hence in this investigation any reading about 48 would ordinarily be taken as indicating undue respiratory contamination and poor ventilation, the mean reading for the outdoor air being about 28.

"The process employed for the determination of the carbon dioxide (Pettenkofer's method, slightly modified) is quite exact, and it is believed that 2 parts per 100,000 represents the extreme error. This error is demonstrated in determinations 23 and 24, which should have agreed. The error resulted from not sufficiently shaking up the vessel after the introduction of the barium hydroxide solution; and reaching a probable maximum of 2 parts per 100,000 at reading No. 24 is believed to have begun at about reading No. 10, the results beginning to be slightly low at this point.

"The outside air may be considered to contain about 28 parts of carbon dioxide per 100,000 (see readings Nos. 13, 21, 23, 24). The exhaust air from the two chambers showed 32, 37 and 40 parts (readings Nos. 11, 14, 15 and 34), a fair average for this air, during a long session of the house, being probably something less than 40.

"The basement air seems to be quite pure, in consequence of the circulation due to the heat of the engine rooms. Of course, in occupied, poorly ventilated spaces, of which there are a number in the Capitol basement, the

*Read at the annual meeting of The American Society of Heating and Ventilating Engineers, New York, Jan. 24-26, 1911.

		Parts per 100,000
1.	Temporary laboratory, Capitol basement (terrace)	66
2.	Same, after longer occupation	77
3.	House inlet, just inside door to basement	33
4.	Same	30
5.	House, men's gallery	61
6.	House floor, rear of Democratic side	41
7.	House basement, at door to engine room (draft into basement)	28
8.	House floor, Democratic side, east end	39.5
9.	House floor, Republican side, west end	45
10.	House floor, Democratic side, near center aisle (Wicklif)	57
11.	House attic, shortly after adjournment	32
12.	House basement, draft outward into engine-room	47
13.	Air inlet, senate	27
14.	Senate attic (in session two hours)	37
15.	House attic (in session four and one-half hours)	37
16.	House floor, Democratic side, near center aisle (Wicklif)	31
17.	Same, Republican side (Keane?, New York)	46
18.	Senate floor, open space in front of Chair	57
19.	Same, back, Democratic corner	39
20.	Same, Republican side, between Smith and Stevenson	54
21.	Senate inlet	26
22.	House duct, to windward of fan	29
23.	House inlet	26
24.	Same	28
25.	House basement, near engineer's office	31
26.	Senate floor, front, Democratic corner	48
27.	Senate floor, Republican side	60
28.	Senate floor, front of Chair	61.5
29.	House floor, front of Chair	103
30.	House floor, middle row, Republican side	41
31.	House floor, front of Chair	50
32.	House floor, Republican side, third row	50
33.	House floor, Democratic side, front row, near wall	66.5
34.	House attic (session two hours)	40
35.	Temporary laboratory, terrace	80
36.	House floor, front of Chair (changes of position)	41
37.	House floor, Republican side, fifth row (changes of position)	37
38.	House floor, Democratic side, fourth row (changes of position)	29
39.	House floor, through pipe, middle of Democratic side	32
40.	House floor, pack part of Republican side (changes of position)	32
41.	House floor, front of Chair (changes of position)	43
42.	House floor, front of Chair (one position)	72

air promptly becomes contaminated. This contaminated air tends to ascend into the halls and rooms above, and it is believed that the elimination of the sources of heat in the basement (the removal of boilers and engines when the new powerhouse is put into operation) will prevent this additional contamination of the upper stories.

"The condition of the air on the floors of the chambers was at first a puzzle. The readings obtained from the exhaust air in the attics were low; yet the carbon dioxide readings on the floors varied unaccountably from 31 to 103 parts per 100,000. This wide and irregular variation was finally accounted for as follows: The specimens were taken by sucking the air out of the bottle by a rubber tube, into the lungs, the air from the room filling the bottle at the same time, care being taken to discharge the expired air from the lungs away from the bottle; and where there was a strong air current, as in the air inlets and outlets, none of the carbon dioxide expired from the experimenter's lungs got into the flask and the readings were low. On the floors of the chambers, however, the motion of air was very slight, and the experimenter's breath contaminated the whole atmosphere for a radius of several feet from his face, including, of course, the portion of the air from which the sample was drawn.

"On the other hand, when precautions were taken to escape this contaminated air (as by taking the specimen through a pipe from below the

floor, No. 39, or by moving while taking the specimen), the readings were again relatively low. The effect of this is shown by results Nos. 41 and 42, in which the conditions were practically identical, except that in one case the examiner moved about, while in the other he stood still, and, holding the bottle well out of the way during expiration, held the bottle as near as possible to the face during inspiration, so that the air which went into the bottle very accurately represented the air as it is actually breathed by the members on the floor during a session.

"At first sight it would appear that the results obtained when part of the carbon dioxide in the sample came from the experimenter's own breath should be considered of no value. On the contrary, when controlled by experiments in which this factor is eliminated, they are highly instructive, since they show that conditions are such that, although an abundance of air is supplied, the distribution is faulty, and the members occupying the floors of the chambers rebreathe their own breath, while a large quantity of pure air passes unchanged and unmixed through the chambers to the outlet."

APPENDIX TO THE REPORT ON THE ANALYSIS OF THE AIR AT THE CAPITOL

"The method employed for the determination of the carbon dioxide was a modification of Pettenkofer's method, as follows:

"Several glass containers, holding in the neighborhood of 4,000 c.c., were measured as to their cubic capacity by weighing first when empty and dry, and then when filled with water. Elenmeyer flasks with mouths about 1½ in. in diameter were preferred on account of the convenience in cleaning and drying, but not enough of these were available, and bottles of the ordinary shape had to be used sometimes. These containers were stopped with rubber stoppers, which in turn were bored with a hole about ⅜-in. in diameter, and closed with a small, hard, red rubber stopper.

"In taking the sample air in the bottle was sucked out by a rubber tube reaching to the bottom, the larger stopper being removed. About 10,000 c.c. of air, on the average, were passed through the bottle; the mouth was then tightly closed and the bottle taken to the laboratory. Fifty cubic centimeters of barium hydroxide solution of known strength (see below) were introduced by means of a burette through the hole in the large stopper, the small one being removed. The flask was then again tightly closed and set away for an hour or more, the contents being gently agitated at intervals. (The occasional agitation appeared to be necessary to complete the absorption within a reasonable time.)

"In the meantime some of the same barium hydroxide solution was titrated against the standard oxalic acid solution as follows: 25 c.c. of the barium solution was run from the burette into a 100 c.c. volumetric flask and one drop of 1% phenolphthalein solution added, producing a deep red coloration. From another burette the standard oxalic acid solution was added until the color was exactly discharged. The oxalic acid solution contained 2.819 grams of acid to the liter, and one cubic centimeter was equivalent to 0.5 c.c. of carbon dioxide at 0° C. and 760 mm. pressure.

"The value of the 50 c.c. of barium hydroxide solution being thus determined, and sufficient time having elapsed for the complete absorption of the carbon dioxide in the sample of air in the 4,000 c.c. container, a drop of the phenolphthalein solution was introduced into the latter, a final shake given to color the liquid uniformly, the small stopper removed, and the nozzle of the burette containing the oxalic acid solution introduced, and the acid run in until the color was exactly discharged. The difference between the strength of the barium solution weakened by the carbon dioxide in the large container, and of the unaltered barium solution, represents the amount of carbon dioxide in the sample. A correction for temperature and pressure must be

made, and for convenience a table covering the ordinary ranges of temperature and pressure may be made.

"The following is a sample of the results:

DETERMINATION No. 16, 4:50 P.M., MARCH 29, 1910.

Floor of House, just after adjournment; Democratic side, near center aisle (Wicklif, Louisiana.)

Temperature, 25° C. Correction factor, 92.3%.
Barometer, 30.16 in.

50. c.c. $Ba(OH)_2$ sol. (unaltered)..... 31.6 c.c. oxalic acid.
50. c.c. $Ba(OH)_2$ sol. (after exposure)..... 29.3 c.c. oxalic acid.

2.3 c.c. difference.

1.15 0.923 1.24 1.15 c.c. CO_2 in sample (at 0° C. and 760 mm. pressure).
0.00031 1.24 c.c. at 25° C. and 30.16 in. pressure.

4000) 1.24000 (31 volumes of CO_2 per 100,000.
1.2000

"This procedure is a slight modification of that given in Kenwood's 'Public Health Laboratory Work,' 4th Ed., London, 1908, pp. 160.168.

"The ammonia was determined by drawing 100 liters of the air slowly through a train of three wash bottles containing ammonia-free distilled water. The air was drawn through a lead pipe opening above the level of the tops of the desks about midway from front to back of the chamber, and connected below into the 'plenium' or fresh air space below the floor, through a ventilating opening, where it was connected with the train of wash bottles. The absorbed ammonia, 'free' and 'albuminoid,' was then determined as in water analysis, by distillation and Nesslerization. The two varieties are reported together, instead of separately, because it was impossible to make the distillation until the next day, and the distinction is not as significant in the case of air as in water.

"The sulphur compounds were tested for by slowly passing the air through bromine-water in a train of absorption bottles, whereby the sulphur was oxidized to sulphuric acid. This was tested for by the addition of barium chloride solution and dilute nitric acid. The reaction was controlled by parallel tests on (1) a sample of the same water through which outdoor air had been passed (at the Hygienic Laboratory), and (2) a sample of the same water untreated.

"The carbon monoxide was tested for by shaking up a liter of the air with a dilute blood solution and comparing the color with that of a similar portion of the same blood solution not exposed to the possible action of carbon monoxide.

"All of these methods are derived, with or without modification, from the descriptions in Kenwood's 'Public Health Laboratory Work' (*supra*), in the section on Air Analysis, pp. 149-198."

It might be well to state that Dr. Roberts makes no pretense to being a ventilating expert except as it refers to hygiene.

Attention is called to the following: It will be noted that the report always refers to the CO_2 constituent as parts in 100,000, whereas the heating and ventilating engineer usually refers to it as parts in 10,000 parts of air.

The CO_2 constituent in the air intake, readings No. 13, No. 21, No. 23 and No. 24, average 27 parts in 100,000. This is very low reading, and is accounted for by the fact that the intakes are on the capitol grounds several hundred feet away from the slightest source of contamination and long distances from any serious source of contamination.

The system of ventilation used in the Senate and House chambers is the up-draft. The air is admitted by multiple floor openings, in the legs of the members' desks, etc., and escapes through a perforated ceiling, through which it is drawn by exhaust fans.

The air quantities circulated are

sufficient for excellent ventilation, which is evident upon comparing readings 13, 21, 23 and 24 with 11, 14 and 34, the CO_2 constituent increasing from an average of 27 to an average of 35 parts in 100,000, yet the readings obtained at the floors of the chambers were very much greater, one case (No. 29) being 103.

In the report above quoted Dr. Roberts explains that some samples were taken while he was standing still in the chamber, while others were made with the experimenter in motion. It seems rational to consider the former as the kind of samples in which we are really interested, because they represent just the kind of air a member sitting still in his seat is breathing. The relatively purer air in the aisle beside him or in the "foul air" space in the attic above him does him no good.

It seems that Dr. Roberts was justified in his conclusion that the distribution is faulty, and that a large part of the air as soon as it entered at the floor took a "beeline" for the ceiling openings, and there was little or no diffusion, or at least what diffusion there was took place above the breathing line.

Whether or not better results could have been secured with the downward circulation or some other method is a question on which the experts will disagree, but it is undoubtedly a fact that in this case the upward circulation system had a fair show.

The important point we see emphasized in Dr. Roberts' report is that when we test the CO_2 constituent in an occupied room our result will depend more or less upon where and how we take the sample. A sample taken in the foul air duct might mean little or nothing, especially if the occupants of the room were sedentary. In this case we should get our samples, as it seems to us, near the occupants' heads and in such a way, as Dr. Roberts did to represent accurately the same air the occupant was breathing and not the air over his head or beside him. The closer the results obtained from these samples agree with those obtained from the air in the foul air duct the more efficiency we are getting out of a given quantity of fresh air introduced.

How Wind Affects the Heating of Buildings

Interesting tests showing the effect of wind velocities on the heating of buildings, including the effect of air leakage around windows, are reported in an investigation conducted by a committee on the subject, representing the American Society of Heating and Ventilating Engineers.

The test for wind velocities was made on a group of buildings comprising the Harvard Medical College in Boston. The following tables give the results of these tests, which were presented at the society's recent meeting in New York. The tests for window leakage contained in the report will be presented next month.

HARVARD MEDICAL COLLEGE

A large group of buildings heated from a central plant by means of a forced hot water system. Direct radiation and indirect fan system. Fans in use from 8 A. M. to 6 P. M., Monday to Friday, inclusive. Saturday fan in use from 8 A. M. to 1 P. M.; Sunday, direct only. Use of buildings is such that conditions on one day of the week will compare nearly with same day of the following week. B. T. U. supply determined by recording thermometers on supply and return. Venturi meter determines amount of water circulated. Manometer readings hourly.

Wind velocities and direction and outside temperature taken from U. S. Bureau Records at Federal Building, Boston.

A table showing comparative days of week for January and March, 1910, from the chief engineer's log.

The buildings are of high class construction, and have usual proportion of windows compared with wall surface. Glass area not excessive.

DATE.	Total B. T. U. Supply. 24 Hours, Millions.	Average Outside 8 A.M. to 6 P.M. Hourly, Readings, Deg. F.	Average Outside Temp., 6 P.M. to 8 A.M. Hourly Readings, Deg. F.	Average Wind Velocity Miles per Hour, 8 A.M. to 6 P.M. Hourly Readings.	Average Wind Velocity Miles per Hour, 6 P.M. to 8 A.M. Hourly Readings.	Direction of Wind.
SATURDAY.						
Jan. 1, 1910.....	143	31	35	10.2	16.	S.W.
" 8, "	123	28	26	10.2	6.4	W.&S.W.
" 15, "	232	26	25	20.9	13.8	N.
" 22, "	45	45	37	8.4	16.9	S.W.
" 29, "	100	38	32	10.6	24.8	N.&.W
SUNDAY.						
Jan. 2, 1910.....	123	43	36	14.2	9.5	S.W.&W.
" 9, "	131	30	26	3.5	9.	S.W.&N.
" 16, "	143	38	30	6.7	9.1	N.W.
" 23, "	105	39	34	12.4	6.	S.
" 30, "	98	33	32	18.	8.3	W.&N.
MONDAY.						
Jan. 3, 1910.....	191	32	21	5.5	21.	W.&N.W.
" 10, "	191	30	17	17.3	11.4	N.&W.
" 17, "	156	34	34	7.4	5.4	E.&S.
" 24, "	131	39	38	5.1	4.7	S.&E.
" 31, "	191	31	27	12.4	15.8	N.
TUESDAY.						
Jan. 4, 1910.....	303	6	−1	18.	11.6	N.W.
" 11, "	213	26	24	11.4	9.2	W.
" 18, "	111	46	45	16.9	13.1	W.&S.W.
" 25, "	119	37	35	10.1	10.8	N.&E.
WEDNESDAY.						
Jan. 5, 1910.....	183	15	32	6.8	8.2	N.W.&S.W.
" 12, "	183	30	28	9.	8.	W.&N.W.
" 19, "	150	40	32	14.3	9.5	W.
" 26, "	109	40	37	9.5	5.5	W.
THURSDAY.						
Jan. 6, 1910.....	114	46	40	10.7	6.5	W.&N.
" 13, "	195	30	28	5.5	12.	N.W.&N.E.
" 20, "	136	39	38	8.	7.2	W.&S.W.
" 27, "	127	36	37	7.6	14.2	W.&N.
FRIDAY.						
Jan. 7, 1910.....	121	35	24	15.2	10.7	W.
" 14, "	221	26	18	27.1	24.7	N.E.&N.
" 21, "	79	46	52	15.8	27.	E.&S.
" 28, "	103	38	35	8.7	10.7	W.&N.

DATE.	Total B. T. U. Supply. 24 Hours, Millions.	Average Outside 8 A.M. to 6 P.M. Hourly, Readings, Deg. F.	Average Outside Temp., 6 P.M. to 8 A.M. Hourly Readings, Deg. F.	Average Wind Velocity Miles per Hour, 8 A.M. to 6 P.M. Hourly Readings.	Average Wind Velocity Miles per Hour, 6 P.M. to 8 A.M. Hourly Readings.	Direction of Wind.
TUESDAY.						
March 1, 1910.....	99	39	36	16.	10.	N.E.
" 8, "	94	37	30	6.6	7.3	W.&N.W.
" 15, "	142	40	32	17.3	9.8	W.
" 22, "	47	50	48	7.1	8.7	S.W.
" 29, "	53	67	58	14.	6.	W.
WEDNESDAY.						
March 2, 1910.....	138	38	35	15.	18.	W.
" 9, "	117	40	29	10.	11.8	W.&N.W.
" 16, "	129	45	34	11.7	10.6	W.&N.
" 23, "	91	43	37	10.7	5.	E.
" 30, "	65	50	45	9.8	7.3	E.
THURSDAY.						
March 3, 1910.....	93	45	42	12.	9.	W.&N.W.
" 10, "	114	34	30	8.6	6.2	N.&N.W.
" 17, "	131	29	22	12.6	10.6	N.&N.W.
" 24, "	70	55	53	14.6	16.	S.W.
" 31, "	65	43	43	11.4	10.5	E.&S.W.
FRIDAY.						
March 4, 1910.....	81	43	42	10.	8.	W.&S.W.
" 11, "	112	36	33	8.5	6.2	N.&N.E.
" 18, "	103	35	31	8.7	7.	N.W.&S.W
" 25, "	30	72	50	18.9	11.3	S.W.
SATURDAY.						
March 5, 1910.....	49	50	42	10.5	8.	S.W.
" 12, "	104	36	34	18.4	11.	N.&N.E.
" 19, "	39	44	42	12.8	13.	S.W.
" 26, "	49	49	43	17.9	10.5	N.W.
SUNDAY.						
March 6, 1910.....	52	40	45	8.4	10.	E.&S.
" 13, "	78	39	38	12.4	8.7	N.&W.
" 20, "	26	61	43	18.5	11.	S.W.&N.W.
" 27, "	70	43	38	10.7	10.	W.&N.W.
MONDAY.						
March 7, 1910.....	94	44	34	13.1	14.	W.
" 14, "	145	36	28	19.	12.	W.
" 21, "	79	43	37	8.7	13.	N.W.&S.W.
" 28, "	85	50	49	16.7	13.	W.&S.W.

The Durability of Welded Pipe in Service

By F. N. Speller

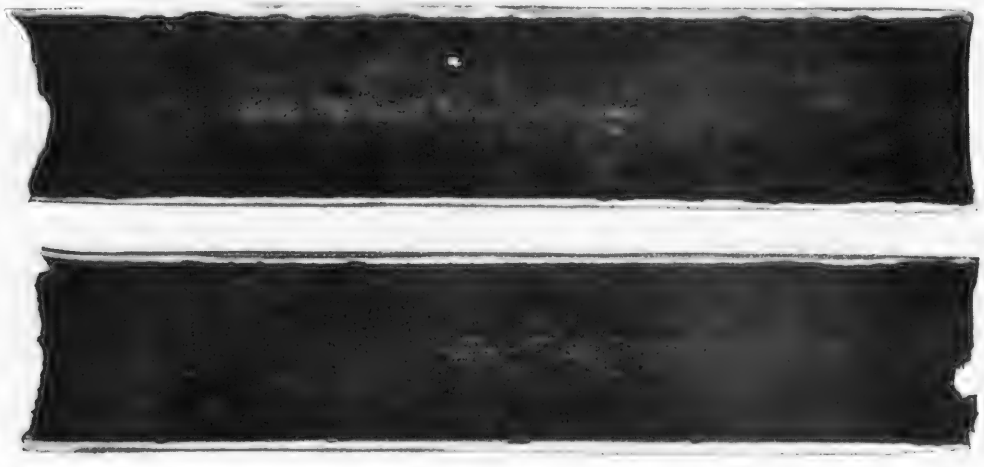
A further contribution to the discussion of the subject of the relative corrosion of wrought-iron and steel pipe is contained in the following paper, which was read from manuscript at the recent annual meeting of The American Society of Heating and Ventilating Engineers. In citing instances where the two kinds of pipe were subjected to comparatively the same conditions, the author makes out a strong case in favor of steel pipe from the standpoint of durability.—[Editor's Note.]

In again opening this much-worn subject for discussion before this society it is my intention to touch on the results of recent investigations which it is believed have a most practical bearing on this important matter.

Before proceeding, let us for a moment review the fundamental reactions involved in the corrosion of iron, so as to have a clear conception of what is going on when, as we say, a pipe rusts. The most satisfactory theory of corrosion is based on the fact that iron is slightly soluble in water, a property common to nearly all materials in nature. In itself this is not of serious consequence, since the quantity dissolved is so extremely small. Moreover, when iron is dissolved the water gives up an equivalent amount of its dissociated hydrogen, which is, so to speak, plated out on the surface of the iron, causing polarization and retarding further solution of the metal. Solution is further retarded by the water becoming saturated with iron as ferrous hydrate.

If we are dealing with water free from dissolved oxygen or acids, an equilibrium is thus soon established, but if oxygen is present it combines with the free hydrogen on the surface of the iron, exercising thereby a depolarizing effect and allowing more iron to go into solution. The ferrous hydrate in solution is oxidized to insoluble ferric hydroxide and precipitated as rust, thus leaving room for more iron to pass into solution.

Therefore, provided a continuous supply of oxygen is at hand, corrosion continues until the pipe is destroyed. Other things will accelerate the reaction, such as the presence of stray electric currents, increased galvanic action on the surface of the metal, the action of acids, etc., but, practically speaking, in the case of water pipes, the amount of corrosion is nearly proportional to the quantity of oxygen brought in with the water, so that water free from dissolved gases is usually quite harmless and will not even discolor the bright surface of iron after years of exposure. It also holds true that air free from moisture is equally



PIPE No. 24.—HOT WATER, BOILER FEED WROUGHT IRON PIPE AFTER TWO YEARS, FOUR MONTHS' SERVICE

PIPE No. 24-S.—HOT WATER, BOILER FEED STEEL PIPE AFTER TWO YEARS, FOUR MONTHS' SERVICE

inactive and will not cause rusting; but we are not concerned with that phase of the problem at this time.

The elementary reaction of corrosion being one of solution, the physical condition of the metal, uniformity in composition, and the nature of the protective coating evidently have an influence on solubility of iron and, therefore, on the rate at which rust will form. These are points which the leading interest in the manufacture of steel pipe has paid considerable attention to for several years past, since the practical significance of these things has been better understood. It is important to remember, however, that solution starts on the surface, and, therefore, that accidental differences in the condition of the surface may be much more influential in promoting solution of the metal than irregularities in the metal itself. This applies particularly to mill scale which forms with iron a galvanic couple having a potential many times greater than the worst possible case of segregated or irregularly distributed impurities found in the metal.†.

†In order to see if there was any relation between the quality of the material judging by the chemical analyses and the local pitting due to corrosion, we selected two pieces of what turned out to be wrought iron pipe from the same line, one sample of which (No. 44) was comparatively free from corrosion, while the other (No. 45) was badly pitted all over. The analyses of drillings taken from these samples are given below:

The author, knowing that in the past fifteen years iron and steel pipe have been made and sold side by side, undertook some investigations to see whether the iron and steel had been by chance installed together in the same lines. Obviously, this would give an ideal comparison, especially in the case of water pipe.

No. 44.		No. 45.
.160%	Phosphorus	.120%
Trace	Manganese	.13
Trace	Carbon	Trace
2.95	Oxides	3.40

In another case a piece of wrought iron was found to be pitted in a few places, but by far the larger portion of the inside surface was free from corrosion. Analyzing the pitted and the clean surface we found the following composition:

	Sample No. 1	
	Around Pits	Clean Surface
Sulphur	.023%	.019%
Phosphorus ..	.370	.310
Manganese	Trace	Trace
Carbon	Trace	Trace
Oxides	2.75	3.00
	Sample No. 2	
	Around Pits	Clean Surface
Sulphur	.021%	.020%
Phosphorus ..	.337	.315
Manganese	Trace	Trace
Carbon	Trace	Trace
Oxides	2.80	3.00

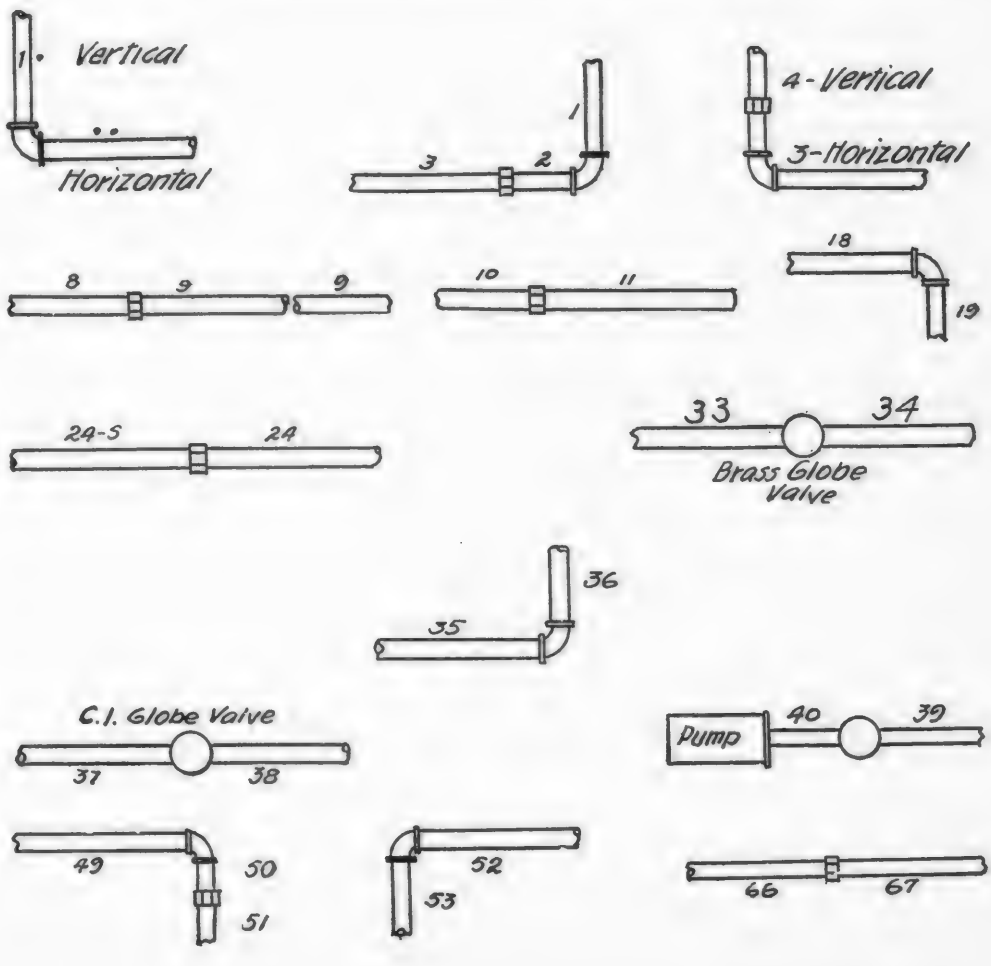
This does not indicate any significant difference in composition. The probable explanation for the difference in effect on materials like the above which have practically the same composition is that the surface exposed to the water was in one case better protected than in the other by the mill scale which naturally forms in the process of manufacture.

DETAIL NOTES ON CORROSION OF WROUGHT IRON AND STEEL PIPES IN SERVICE LINES

Lot No.	Pipe No.	Material. S=Steel W. I.=Wrg't Iron.	Approx. Original Gauge.	Pipe Size Diameter.	Length of Time Installed.	Approx. Portion of Time Installed That Line Was Used.	Character of Service.	Depth of Deepest Pits In Inches.					General Condition.	Percentage Depth of Deepest Pits Wrought Iron Taken as 100%.
1	./	S.	.2"	3"	4–5 Yrs.	Pretty	Hot Water, Boiler Feed	.112	.111	.106	.088	..	Uniformly pitted all over.	129%
	..	W. I.	.2"	3"	4–5 Yrs.	Steady.	Boiler Feed	.094	..	..	..	..	Failed at blister at thread at one end. Rest fairly good.	100
2	::	S.	.2"	3"	7½–8 Yrs.	Two-thirds.	Hot Water, Boiler Feed	.096	.076	.069	..	.	Pitted all over.	88
	..	W. I.	.2"	3"	7½–8 Yrs.			.109	.106	.105	..	..	Pitted all over. Several other deep pits, but metal bent.	100
3	2	S.	.210"	2½"	2 Yrs.	Pretty	Hot Water, Boiler Feed	.107	.096	.076	.076	.076	Fairly badly pitted over most of area.	72 } Av. = 75
	3	S.	.290"	2½"	2 Yrs.	Steady.	Horizontal	.115	.099	..	..	..	Other pits a little less deep, but pipe too rough to measure accurately.	77
	1	W. I.	.195"	2½"	2 Yrs.	" "	Hot Water, Boiler Feed Horizontal.	.149	.095	.060	.073	..	3 failures at threads. Fairly badly pitted all over.	100
4	9	S.	.119"	1½"	2 Yrs.	" "	Hot Water,	.080	.073	.072	.072	.064	Better than No. 8.	53 } Av. for steel = 66
	8	W. I.	.154"	1½"	2 Yrs.		Boiler Feed	.150	.096	.079	.079	.079	Fairly badly pitted.	79
	-9-	S.	.119"	1½"	2 Yrs.		Horizontal	3 (failures in) metal.			.096	.096	1 Flr. at thread. Pitted uniformly	..
Note:	-9- other end of No. 9.													
5	10	S.	.136"	1½"	2 Yrs.	" "	Hot Water,	.015					Good. Few slight pits.	14
	11	W. I.	.175"	1½"	2 Yrs.		Boiler Feed Horizontal.	.107	.096	.091	.091	.076	Bad pits in a few places.	100
6	18	S.	.230"	4"	2 Yr. 4 Mo.	" "	Hot Water,	.170	.170	.169	.167	.167	Badly pitted all over.	83
	19	W. I.	.239"	4"	2 Yr. 4 Mo.		Boiler Feed	.204	.192	.192	.192	.175	Badly pitted all over.	100
Note:	No. 18 horizontal.			No. 19 vertical.										
7	24-S	/S.	.200"	4"	2 Yr. 4 Mo.	" "	Hot Water, Boiler Feed	.199	.182	.182	.168	(1 Flr	1 Flr. at thread. Bad pits all over.	96 } Taking failure in metal as pit depth = original gauge.
	24	W. I.	.250"	4"	2 Yr 4 Mo.		Horizontal.	.208	.186	.181	.169	.	About 5 Flrs. thr'ds. Bad pits all over.	100
8	33	S.	.145"	2"	2 Yr. 2 Mo.	" "	Hot Water Boiler Feed	.096	.088	.078	.078	..	1 Flr. at thread. Fairly badly pitted all over; mostly at ends.	81
	34	W. I.	.145"	2"	2 Yr. 2 Mo.		Horizontal.	.119	.113	.108	.090	..	1 Flr at thread. Fairly badly pitted in several places.	100
9	36	S.	.199"	3"	2 Yr. 2 Mo.	" "	Hot Water	.110	.094	.092	.078	.069	No. 35 pitted uniformly all over internal surface.	126
	35	W. I.	.204"	3"	2 Yr. 2 Mo.		Boiler Feed Horizontal	.087	.074	.071	.068	.068		100
10	38	S.	.247"	4"	3 Yr. 6 Mo.	" "	Hot Water	.122	.114	.111	109	.100	Very bad pits in area	182
	37	W. I.	.250"	4"	3 Yr. 6 Mo.		Boiler Feed Horizontal	.067	.063	.061	.059	.048	Comparatively few pits.	100
11	39	S.	.217"	4"	1 Yr. 2 Mo.	" "	Hot Water Boiler Feed	.061	.039	..	..	..	Other pits of less depth, but difficult to measure	71
	40	W. I.	*	4"	1 Yr. 2 Mo.		Horizontal	.086	.082	.080	.078	.075		100
*Slightly heavier than No. 39.														
12	42	S.	.160"	2"	1 Yr. 11 Mo	" "	Hot Water Boiler Feed Horizontal	.125	.109	.105	.083	..	1 Flr at thread. Very badly pitted all over	107 } Taking average of deepest pits of the two I. and of the two S.
	43	S.	.160"	2"	1 Yr. 11 Mo			.118	.110	.088	.071	.056	Bad pits in some areas except for these very good	..
	44	W. I.	.150"	2"	1 Yr. 11 Mo			.058	.041	..	..	..		53
	45	W. I.	.153"	2"	1 Yr. 11 Mo			.060	..	..	..	..	Several more pits, but pipe bent. Could not measure	
				(Exact positions of each piece unknown.)										
13	49	S.	.246"	2½"	6–9 Mo.	" "	Hot Water Boiler Feed Horizontal	..	..	..	..	.	Rough surface with hard scale. Fair size pits all over.	
	50	W. I.	.232"	2½"	6–9 Mo.	" "	Hot Water Boiler Feed Horizontal	..	..	..	..	..	Slight pits. Rusted uniformly all over, not much pitting.	Impossible to measure pits of No. 49 and 50 accurately.
	51	S.	.270"	2½"	6–9 Mo.	" "	Hot Water Boiler Feed Horizontal	.090	.081	.080	.080	.076	Bad pits in several areas.	
14	52	S.	.310"	4"	6 Mo.	" "	Hot Water Boiler Feed	.092	.091	.090	.084	.083	Fairly bad pits scattered all over	72
	53	W. I.	.310"	4"	6 Mo.		Horizontal	.128	.121	.118	.110	.101	Bad pits all over.	100
15	28	S.	.149"	2"	4 Yrs.	.....	Hot Water Boiler Feed	.089	.088	.039	Other slight pits.		Fairly bad in several areas. Rest protected by scale.	101
	29	S.	.132"	2"	4 Yrs.	.....	Hot Water, Boiler Feed	.112	.101	.099	.081	.069	Uniformly pitted all over	
	26	W. I.	.170"	2"	4 Yrs.	.....	Hot Water Boiler Feed	.089	.089	.069	.065	.059	Uniformly pitted all over	
	27	W. I.	.172"	2"	4 Yrs.	.....	Hot Water, Boiler Feed	.089	.084	.083	.075	.065	Uniformly pitted all over	Taking average of deepest pits of two steel and fine iron pipe
	30	W. I.	.157"	1½"	4 Yrs.	.....	Hot Water, Boiler Feed	.113	.106	.106	.100	.096	Number of very bad pits in places.	
	31	W. I.	.175"	1½"	4 Yrs.	.....	Hot Water, Boiler Feed	.114	.104	.104	.101	..	Number of very bad pits in places.	100
	32	W. I.	.147"	2"	4 Yrs	.....	Hot Water, Boiler Feed	.092	.088	.081	.040	..	Fairly badly pitted in several areas. Rest protected by scale.	

Note: These pipes removed when repairing boilers. All the old piping was removed, and there was no way of telling what position these pipes occupied or how steadily they have been used.

Lot No.	Pipe No.	Material S-Steel W.I. Wr'g't Iron.	Approx. Original Gauge.	Pipe Size Diameter.	Length of Time Installed.	Approx. Portion of Time Installed That Line Was Used.	Character of Service.	Depth of Deepest Pits In Inches.					General Condition.	Percentage Depth of Deepest Pits Wrought Iron Taken as 100%.
16	67	S.	..	1"	.....	.....	Horizontal Cold Water Line in Hot House	..	..	..	..	..	No. 66 was more pitted than No. 67, but both pieces bent, so impossible to measure pits accurately. Neither affected very seriously.	
	66	W. I.	..	1"	.....	.....		..	..	..	..	..		
17	54	S.	.297"	3"	1 Yr. 3½ Mo.	Pretty Steady.	Hot Water Boiler Feed Horizontal.	.100	100	.096	.096	.085	Area covered with pits on No. 54 a little less than on No. 55.	87
	55	W.I.	.309"	3"	1 Yr. 3½ Mo.			.115	.103	.102	.099	.093		100
18	57	S.	.286"	3"	1 Yr. 3½ Mo.	" "	Hot Water Boiler Feed Horizontal.	.118	.111	104	.104	.097	Pitted all over	111
	56	W.I.	.303"	3"	1 Yr. 3½ Mo.			.106	104	099	095	.090	Pitted through to lamination at one end; impossible to measure. Bad pits all over	100
19	60	S.	.307"	3"	1 Yr. 3½ Mo.	" "	Hot Water Boiler Feed Horizontal.	.123	.122	.120	.114	.111	Very badly pitted in areas.	95
	59	W.I.	.317"	3"	1 Yr. 3½ Mo.			.129	.124	.124	.114	103	Very badly pitted all over	100
20	65	S.	.313"	3"	1 Yr. 3½ Mo.	" "	Hot Water Boiler Feed Horizontal.	.127	.120	.114	.111	.111	Bad pits scattered.	117
	66	W.I.	.315"	3"	1 Yr. 3½ Mo.			.109	.098	.092	.085	.082	Very badly pitted all over.	100
21	67	S.	.287"	3"	1 Yr. 3½ Mo.	" "	Hot Water Boiler Feed Horizontal	.089	.088	.088	.087	.068	Fairly bad pits all over.	82
	66	W.I.	.315"	3"	1 Yr. 3½ Mo.			.109	.098	.092	.085	.082	Very badly pitted all over.	100
														Average of percentages (Lots Nos. 13 and 16 not included). Steel, 99%, Iron, 100% (Depth of pitting in Wrought Iron taken as 100).



A TEST OF STEEL AND WROUGHT IRON PIPE UNDER COMPARATIVELY EQUAL CONDITIONS

Let us consider for a moment the results of a study of pipe removed from hot-water supply lines in the New York City baths which was undertaken by Prof. Ira H. Woolson, formerly of Columbia University, now consulting engineer of The National Board of Fire Underwriters.* Briefly, he found that out of 86 pieces in eight bathhouses, which had failed through corrosion, 23% were wrought iron, a larger proportion than might be expected, judging by the relative proportion of wrought iron to steel on the market. In cases where pieces of iron and steel were removed from the same line they were found to be equally corroded. The samples shown are cases in point.

We recently had an opportunity to examine the boiler feed-water pipe at the mines of the Frick Coke Company, which had been giving trouble in this way. Means were found to identify the pipe without removing it from the system. As anticipated, we found a number of cases where wrought-iron and steel pipe had been put in together. Samples of such pieces were removed and cut open for examination. The results of corrosion were expressed in terms of the depth of the deepest pits as was done by Mr. T. N. Thomson in his interesting experiments in hot-water service lines. The results, so far as completed, are given in the table on Page 24.

Generally speaking, these figures and inspection of the interior of these pipes show that there would be nothing to gain by using wrought iron. A similar case of comparison in a cold water line was found is a greenhouse near Pittsburg with the same results. (Nos. 66 and 67, same table.)

A CASE OF CORROSION OF HOT WATER PIPING

We recently had an opportunity to investigate the piping in an apartment in New York City where they were having trouble with the leaking of hot water lines which had been in service about six years. The second or third piece examined proved to be wrought iron and was found in the condition shown. The other sample taken from the system through which the same water had been continually circulated illustrates how the steel was affected. This intermixture of iron and steel pipe can be explained by accidental intermixture in the manufacturers' or jobbers' stocks, and appears to be quite general.

PREVENTION OF CORROSION IN PIPES

If the trouble is not due to the material, why is corrosion so much more serious nowadays, and how can conditions be bettered?

Going back to the principal factor in corrosion, viz., the air dissolved in water, it has been found that oxygen is more soluble than nitrogen, so that the proportion of the two gases in solution is about two volumes of nitrogen to one volume of oxygen, instead of five of nitrogen to one of oxygen as in the atmosphere. Pure water at normal pressure will dissolve 14.7 parts per million of oxygen at 32° F. and 7.60 parts per million at 86° F. At 210° F. oxygen is practically insoluble.

So by heating the water the solubility at normal pressure becomes less, but as water is usually heated in closed heaters under pressure the gases are forced to remain in solution and in this condition the water may be said to be supersaturated. It is quite possible that in this state the oxygen is more active; the more so the higher the pressure. On drawing off hot water from such a line into a glass the gas is released and may be readily seen. Experiments have shown that under normal pressure water and air are most active in corrosion between 140 and 180° F.

Evidently, then, if, as is the case, much more hot water is being put through service lines (particularly in large hotels, apartment houses and factories) today, we must expect a proportional increase in corrosion; so that, if three times as much hot water is being run through a pipe of given size under the same pressure and temperature, the pipe, instead of lasting twenty-one

*Engineering News, December 8, 1910.

years, will only last about seven years.

Knowing, as we now do, something of the cause and principles of prevention of corrosion, it should be possible for engineers to do much to remedy this state of affairs. Apparently there is as little need of corrosion in pipes and tubes around boilers and in hot water heating and supply systems as there is for smoke from a modern power plant. The author is now trying out a system for removing dissolved gases from water by heating the water to a sufficiently high temperature, preferably under normal atmospheric pressure or a vacuum, and then cooling if necessary by passing the air-free water through a form of economizer designed like a closed feed water heater in which the excess heat in the air-free water is taken up by the cold feed on its way to the heater. This provides for a continuous supply of air-free water for service lines at any temperature. The treatment may with advantage be carried out on the roof slightly below the level of the cold water standpipe. Another scheme for accomplishing the same purpose was proposed by the Royal Commission appointed to investigate the cause of corrosion in the Coolgardie (Australia) water supply main. They found after a thorough study of the situation that the conduit was suffering on account of oxygen dissolved in the water, and recommended that the supply be sprayed into vacuum chambers with the addition of 3 grains of lime to the gallon before passing into the pipe. A plant was designed for this purpose on the principle of a barometric condenser.*

The addition of ferrous sulphate and some alkali to water filtering off the hydrate of iron before the water enters the line has been found quite effective in removing oxygen from solution. By rendering the water slightly alkaline before passing into the pipes corrosion may be greatly lessened even though free oxygen is present. In many cases however, this would interfere with the use of the water for certain purposes.

Doubtless other means will be found to remedy the trouble when the economic importance of the problem is fully realized by engineers. Elaborate plants are provided for treatment of boiler water, which pay for themselves in a few years many times over, but so far in this country we continue to suffer loss in water lines and as a rule the responsibility is shifted onto the pipe manufacturer. Not that pipe cannot be improved, for steel pipe is now being made which is much better than that put out ten years ago, and even superior in lasting quality to the much-talked-of brands of wrought iron. Protective coatings more suitable for modern conditions are also possible, but why not endeavor to apply the obvious remedies and remove the fundamental cause of the trouble?

*Engineering Record, May 21, 1910.

Tight Storm Windows a Cause of Disease

That West Duluth, Minn., is a hotbed for tuburculosis, and that this is caused from the fact that the people in this part of the city use improper methods in ventilating their homes during the winter months is the statement made by Mrs. Florence Lee, visiting nurse for the State Anti-Tuberculosis Society.

Mrs. Lee states that the western end of the city has more tuburculosis cases than any other part of Duluth. An investigation made by her recently revealed the fact that the cause of most of this was from the use of the wrong kind of storm windows.

These storm windows, Mrs. Lee says, are, in the majority of cases, nailed on tight early in the fall and from then on until late in the spring the rooms receive no pure air. The small slit which is furnished in some of the windows for the purpose of giving ventilation is inadequate to properly allow the fresh air to circulate in the rooms.

She advocates the use of storm windows which may be swung out from the top and keeping open all the time with the exception of possibly the coldest of weather.

Is the CO_2 Air Test a Fallacy?

A CORRECTION

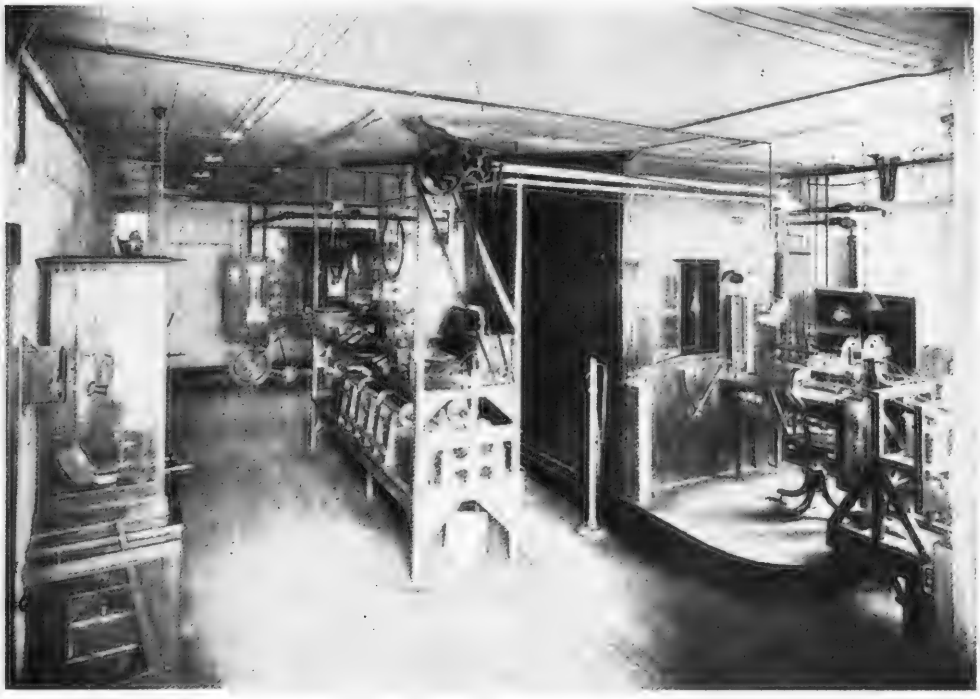
So much interest has been aroused by the description, in THE HEATING AND VENTILATING MAGAZINE for February, of tests recounted by Dr. Luther H. Gulick, in which human beings were confined in highly vitiated atmospheres, that we take pleasure in presenting herewith a view of the respiration calorimeter laboratory at Wesleyan University, in which many of the experiments were made.

The correct size of the respiration chamber itself is 7 ft. 6 in. long, 4 ft. wide and 6 ft. 6 in. high. It will, therefore, be seen that the chamber contains 197.60 cu. ft. of air space, which is somewhat reduced by the inside furnishings, including a chair, table and bed, all of which could be folded and put aside when not in use.

It should also be stated that the air supply in the various tests, which is expressed in liters, may be read in cubic feet by figuring a liter as 61 cu. in. or 0.0352 cu. ft. Thus, the supply of air in many of the experiments, which was mentioned as 100 liters per minute, would be equivalent to 3.52 cu. ft. In another case, where the supply was reduced from 100 to 75 liters, it would be equivalent to from 3.52 cu. ft. to 2.62 cu. ft. per min. In a third case, where the supply of air was reduced to 55 liters, it would be equivalent to 1.92 cu. ft. per minute, which was the smallest figure reached.

The Heating of Portable Buildings

A system of heating and ventilation has been installed in the portables and annexes of the school buildings throughout Everett, Wash., and now these one-room buildings, which have been heretofore a menace to the health of pupils, are as well heated and ventilated as the best of the large systems. The twenty plants installed were made by the Smith Heating works of Milwaukee. They consist of a large round steel asbestos lined shield which encloses a regular coal stove, while from the outside is connected a fresh air pipe through which cold fresh air passes, entering a distributing hood in the bottom of the shield



GENERAL VIEW OF RESPIRATION CALORIMETER LABORATORY AT WESLEYAN UNIVERSITY. RESPIRATION CHAMBER ON THE RIGHT

which forces the air to come in contact with the heat from the stove, and in this way the air thus heated is distributed through the room.

On the stovepipe is arranged a mixing dome with a large ventilation pipe which, by an elbow, extends nearly to the floor. By the draft of the stove a strong suction is formed so that the foul air is drawn from the floor and goes out through the chimney. Another convenience is that the stove will now take up less room and may be placed in a dark corner, giving the lighted portion of the room to the pupils.

Infected Milk May Be Caused by Poor Ventilation

It is a well known fact that there is a crusade now being carried on against infected milk, through tuberculosis in cattle. If it is necessary for *humanity* to have a proper amount of air to withstand disease, then *cattle* should have it too, as they provide food in the early stage of life, and the very existence of our country depends upon how our children are brought up; your duty therefore, is, to *attract the public* as much as possible by putting before them the absolute necessity of a proper system of ventilation and heating.—JOHN H. BLIZARD, *before the (British) Institution of Heating and Ventilating Engineers.*

Philadelphia's Director of Health Urges Ventilation for Prevention of Pneumonia

Dr. Neff, Philadelphia's director of health, believes in keeping his department constantly in the public eye. He is out with a circular detailing the dangers of pneumonia and telling how to prevent it. "Ventilation is the keynote of prevention from pneumonia, whether in office, public building, sitting room or bed-room," says Dr. Neff. "Day and night pure air should be breathed. The old superstition that the breathing of night air is conducive to disease has been eliminated from the minds of nearly all by public education, with the exception of a few of our foreign population, who still believe that some diseases are spread by the breathing of night air. As a matter of fact the night air is purer than the day air, as there is less black smoke belching from chimney stacks and locomotives and less dust in the air, owing to reduced street traffic; so windows should be opened both top and bottom in every sleeping room."

Fresh Air Reduces Death Rate

In the weekly bulletin of Chicago's health department, it is reported that in October, 1909, 381 persons were killed by pneumonia. In October of this year, 247, a saving of 134 deaths. This would indicate that the department's teaching and preaching as to the danger of dirty air are bearing fruit. It means that some people are learning that it is better to ventilate than to hibernate. They are beginning to understand that the druggists have no remedies in stock that are as good for maintaining bodily health and vigor as fresh, pure air.

Radical Legislation Proposed to Ventilate Closed Rooms

The following bill was introduced in the last Indiana legislature by Henry M. Williams, of Fort Wayne, Ind.:

"Be it enacted, etc., etc., that on and after four years from the date of the passage of this act it shall be unlawful to construct any room, with floors and windows that can be closed in any building designed for human habitation unless the same be provided with an outlet opening on the floor or in the baseboard next the floor, in size proportioned to the cubic contents capacity of the room to be determined by the board of health of the state of Indiana, the said outlet opening to be connected directly or indirectly with the outdoor air."

The subject was introduced by Dr. John Guerin, the original advocate of "open-air" schoolrooms.

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WE TAKE pleasure in announcing the publication, commencing in the April issue, of a series of articles on the subject of central station heating. These articles will cover every important phase of this subject, which has thus far received remarkably scant attention in the way of published data. Indeed, there is no one publication to be had which attempts to cover all of even its more important phases, and it is in an endeavor to remedy this deficiency that the forthcoming series of articles, dealing with present-day practice in central station work, has been prepared. The articles will be from the pen of Byron T. Gifford, of Chicago, whose experience in this field of engineering qualifies him to a marked degree to speak authoritatively on this important subject. The first article by Mr. Gifford, which will appear in the April issue, will discuss, in a new and thoroughgoing manner, the matter of pipe sizes in central station heating work.

REPORTS from Chicago indicate that that busy city is likely to be the scene of important developments in the steam fitting trade in the near future. The sequence of news already available may be summed up as follows:

The formation of a "major heating league" in the State of Illinois by master steam and hot water fitters to secure better trade protection.

A formidable movement on the part of the International Union of Journeymen Plumbers to disrupt or absorb the International Union of Steam Fitters in Chicago.

The largest meeting since its organization of the Chicago Association of Heating and Ventilating Contractors and Engineers.

The selection of Chicago as the place for holding the twenty-third annual convention of the National Association of Master Steam and Hot Water Fitters.

The conditions here indicated would seem to be ripe for some constructive work of the first magnitude in regard to the bettering of trade conditions in the Middle West. No doubt a determined effort will be made to bring about closer harmony in the trade, but the question is, will the old mistakes be repeated and the negotiations split on the rock of ultra conservatism on the part of the East versus ultra radicalism heretofore imputed in this connection to the West? It is safe to say that only by overlooking past differences and by approaching the subject through new men and new measures can any permanent degree of progress be attained in the furthering of the association idea in this particular direction.

Annual Meeting of British Heating Engineers

The annual general meeting of the (British) Institution of Heating and Ventilating Engineers was held in London February 14, with the retiring president C. Ingham Haden in the chair. Among those in attendance was Theodore Weinshank, of Indianapolis, a member of the American Heating Engineers' Society. Mr. Weinshank addressed the meeting on the subject of ventilation.

On assuming office the new president, O. M. Row, M. I. Mech. E., of Irlam, Manchester, delivered his inaugural address in which he said:

"I take it as a main principle that hot water radiation is the best for hygienic purposes, and of course there are many ways of applying the heat, namely, various fuels, coal, coke, gas, steam, but let the heated water be the only direct means by either natural or forced circulation.

O. M. ROW
Newly-Elected President

"Ventilation and plenty of it, is of the utmost importance, but I am seriously under the impression that such ventilation as a large green box, with only three sides, out on the green sward, and exposing delicately constituted people to the rude atmosphere of our climate is cruelly wrong.

"I hear people talk of cold bedrooms, open windows, wind and rain (and sometimes snow) blowing across their beds and freezing their eye lashes, etc. This is all nonsense, (if one may be forgiven such an expression); give me a good radiation from hot water surface, and then plenty of properly disposed inlet and outlet vents, and my night's rest is perfect and health giving. People in this country seem frightened almost to death at a bit of first cost, which often means a permanent economy and comfort.

"I think we may look hopefully for a closer and very sympathetic connection between the old country and our brothers of the colonies of the Empire, our cousins of the United States of America, and all English speaking people, and all that is possible should be done to establish interchange of ideas which will broaden our minds and strengthen our knowledge."

A paper was read by John H. Blizard, A. M. Inst. C. E., F. R. I. B. A., of Southampton, on "The Ventilation and Heating of Public Buildings in Their Relation to the Prevention of Tuberculosis." This was followed by an address given by W. H. Hurtley, D. Sc., of St. Bartholomew's Hospital, London, on "The Air of Inhabited Rooms With Special Reference to Dust" and a "Case of Corrosion by Water of the Hot-Water Pipes at a Sanatorium."

The dates of future meetings were fixed as follows:

Summer meeting at Chester, July 3 and 4.

Autumnal meeting, October 17, at the Institution of Mechanical Engineers, Storey's Gate, London, S. W.

Annual meeting, London, on February 6, 1912.

The usual dinner followed the general meeting and a very enjoyable evening was spent.

The new president, Oliver M. Row, M. I. Mech. E., joined the institution as a member in 1902. In 1881, at the age of 22 years he became manager to Hocking and Company, Limited, of Liverpool, distillery and heating plant manufacturers. While there Mr. Row developed his interest in the problems attaching to the distillation of water for drinking purposes, bringing out several patents connected with this and similar work. Notable among his inventions is the "Row tube," perhaps the most effective type of tube yet invented for steam heating purposes. Later, Mr. Row took over the business himself, afterwards coming to Manchester, where, in conjunction with Mr. J. J. Royle, was started the Irlam works of Royles, Ltd.

In 1906 Mr. Row was awarded the silver medal of the Institution of Heating and Ventilating Engineers for the paper on "The Uses of Steam for Heating Purposes," and a bronze medal was awarded to him at the Franco-British Exhibition in 1908 for his contribution of apparatus for "Heat Transmission."

Current Heating and Ventilating Literature

Under this heading is published each month an idex of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the articles mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

FAN BLAST HEATING

Design of Fan Blast Heating. H. C. Russell. Gives data on the proportioning of heating apparatus for factories, schools and public buildings. 2000 w. Met Work.—Jan. 21, 1911. Serial. 1st part. 20c.

PIPE SIZES

Deduction of a General Formula for Determining the Most Economic Size of Pipe to Carry Pumped Water. Shows a simple rule closely applicable under wide variations of pipe, fuel and pump costs. 4000 w. Engng-Con—Jan. 25, 1911. 20c.

PLANT DESIGN

Design of Steam Power Plants. William F. Fischer. Discusses the factors to be considered. 2000 w. Power—Jan. 24, 1911. 20c.

STEAM PIPING

A Simple Method of Determining Sizes of Pipes for Low-Pressure Steam-Heating. F. E. Giesecke. Diagrams and explanation, illustrated by problems, and giving related information. 3500 w. Dom Engng—Jan. 14, 1911. 20c.

SUPERHEATERS

Modern Steam Superheaters. Warren O. Rogers. General illustrated description of American superheaters, dealing with features of design and application. 3500 w. Power—Jan. 3, 1911. 20c.

VENTILATION

Mechanical Ventilation. J. Radcliffe. Based on a paper read before the Heat. & Vent. Engrs. Discusses the requirements of a perfect system of ventilation and means of attaining the desired results. 3000 w. Mech Engr—Jan. 6, 1911. 40c.

Proposed Factory Ventilation Law for Wisconsin

Through the activity of the Wisconsin State Federation of Labor a bill has been introduced in the Assembly by Mr. Vint, relating to the ventilation of manufacturing and mercantile establishments. The bill was referred to the Committee on Labor and Labor conditions. Following is the full text of the measure:

"Section 1. There are added to the statutes three new sections to read: Section 1636-321. In factories, mills, workshops, mercantile or mechanical establishments, the windows shall be so arranged that they will permit of the circulation of fresh air from the outside of the building at all times, and shall be so constructed as to prevent direct drafts from striking the employees working therein. Where the circulation of fresh air cannot be satisfactorily secured through an arrangement of the windows, any system of ventilation that will keep the air therein free from substances and qualities injurious to the health or comfort of the employees, either by fans, suction devices and the like, which shall be approved by the bureau of labor and industrial statistics, may be installed.

"Section 1636—32m. Every factory inspector and every assistant factory inspector charged with the inspection of factories, mills, workshops, mercantile or mechanical establishments, shall investigate the system of ventilation in every plant inspected, and wherever same is not found to comply with the provisions of this act, notice thereof shall be given to the owner or owners thereof, or to the officer or officers, if said factories, mills, workshops, mercantile or mechanical establishments be corporations. Whenever the owner or owners of said factories, mills, workshops, mercantile or mechanical establishments, or officer or officers of said plants do not take steps to remedy the system of ventilation, after due notice of defects thereof has been given in accordance with the provisions of this act, said owner or owners thereof, or the officer or officers thereof shall be punished by a fine of not less than $25.00 nor more than $500.00, or by imprisonment not less than thirty days, nor more than six months, or by both such fine and imprisonment.

"Section 1636—32n. It shall be the duty of the district attorney of every county in this State to prosecute all violations of this act upon complaint of any officer of the State or any citizen."

Congress of Technology

A congress of technology, at which will be presented a series of papers dealing with the place of science in modern industry, will be held in Boston, April 10-11. The first of these dates is the fiftieth anniversary of the chartering of the Massachusetts Institute of Technology and the primary purpose of the congress is to fittingly mark that anniversary.

The whole body of papers to be presented will constitute a survey of engineering and industrial science as a whole, from a body of men who will speak from first-hand experience with industrial problems.

The papers, separately, will discuss the conditions and prospects in specific industries. No similar discussion of the industries has been attempted on such a scale, and the record promises to be of unique suggestive value to the manufacturers of the country. The meetings will be open to the public.

Lower Express Rates from New York to New England Points

Express rates to and from New York and Brockton, Whitman, Rockland, Taunton, North Attleboro, Mass., and Pawtucket, R. I., have recently been lowered 25 per cent., as the result of an order issued by the Interstate Commerce Commission. This new rate took effect Feb. 6, 1911, and applies to what is known as the "boat and rail line" but which is rail to Fall River and thence by boat to New York. The rate was formerly $1.00 per hundred either by rail or water and now it is 75 cents per hundred; small packages accordingly. To secure this rate it is important to mark all packages "via boat and rail." The new rate, as prescribed by the Interstate

Commerce Commission, is the result of a year's litigation carried on by Mr. Henderson of the National Claim Bureau, and R. J. Donovan, both of 170 Broadway, New York, against the Adams Express Company.

CORRESPONDENCE

The Rating of Boilers and the Use of Fuel Gas

EDITOR HEATING AND VENTILATING MAGAZINE:

We note with interest the "Basis for Rating Heating Boilers" adopted by the American Society of Heating and Ventilating Engineers. The committee has probably done as well as could humanly be expected, and its members have shown themselves to be men wise in their generation in shifting to the Committee on Tests the burden of specifying as to the nature of the conditions on which tests for efficiency should be conducted. When we consider that testing under laboratory and working conditions are entirely different propositions, and that, in all probability, no maker of heating boilers now on the market would dare to run his boiler under working conditions under the inspection of disinterested scientific observation, and that we have still to hear that any boiler maker has attained the angelic status of running his business for the general public good, it is fair to infer that said testing committee has had a burden of some weight shifted onto its shoulders, if its findings are to be strictly just, and that it will be some considerable time before such a fair report is made and accepted.

As a matter of fact, the subject of relative efficiencies of boilers will have to be left largely to the decision that will arise from a competitive battle between the manufacturers. It will involve the offer of one or more makers having faith in the quality of their products, backed up by enough cash to make a demonstration, to submit to any fair test under disinterested observation. As the matter now stands the probable efficiencies of a dozen or more makes of boilers are so nearly equal that it would be a rather poor policy for the more active makers to publish such a fact. Certainly those whose outfits comprise the most efficient line of good salesmen and competent advertisers are not likely to do so.

Nevertheless, it will be a good thing for the committee newly emburdened to work at the problem of the conditions under which tests should be made, for in most boilers there is a continual loss of from 10% to 15% in ash wastes, 15% to 30% in imperfect combustion, and from 20% to 35% in chimney gas loss of untransferred heat. A majority of the boilers have less than 50% efficiency, and, in the meantime, the damage done to health, life and property from smoke is enormously great.

When the world realizes that it is entirely practical to convert into an effective fuel gas over 75% of the heat energy of cheap coals, including soft bituminous, lignite and super-hard grades, that such gas can be burned without smoke, and that that gas can be sold at a good profit at prices from one-half to two-thirds less than the usual selling prices for gas, the smoke nuisance will not be tolerated in any town of over 200 houses.

Among the advances now made have been the development of simple fuel gas making plants suited to small installations. In view of the greatly superior economic efficiency and utilitarian advantages of central fuel gas plants, it becomes obvious that centre steam and hot water systems for heating will have no field outside of those which will be concomitant with utilizing exhaust steam or hot water in power plants. But isolated boilers heated by the fuel gas will be used, because of the weight and bulk of the large amount of heating surface required to secure effective transmission of the heat generated.

One of the most important lessons for the heating and power generating worlds to learn is that to secure economic efficiency in heat transmission, a sufficient area of heating surface must be used. The arrangement of that surface is a secondary matter, but decidedly important. It will also have to be accepted as a fact that a perfect smokeless combustion of the easily volatilized fuels is practically impossible in isolated plants more or less completely burning such fuels under atmospheric pressure in immediate relation to heating surfaces. But with a suitable device, designed for the continuous gasification of the fuel without regard to intermittent feeding of the fuel, a complete volatilization of the fuel into burnable gases, a fixation of the tarry or other vapors in the gases and the prevention of untransformed carbon formation is secured.

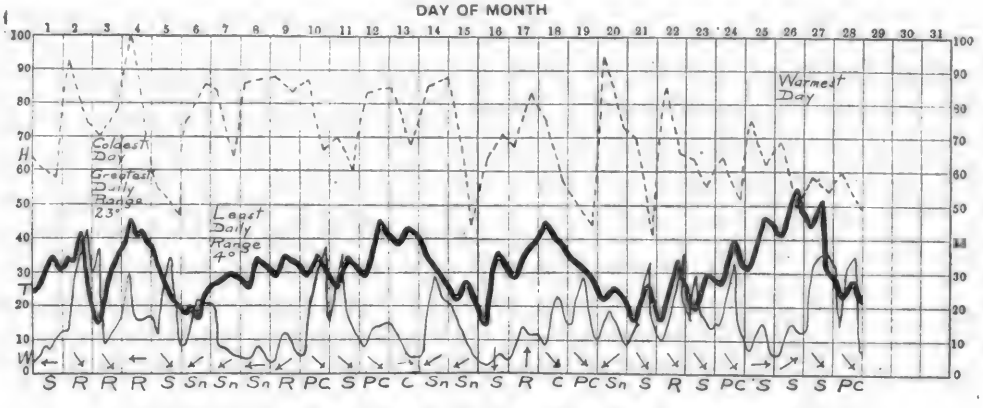
Besides the hygienic and social advantages of generally using a fuel gas in a city like Chicago, the economic savings effected would be something like $200,000 each day. When that recognition is made, the questions of needed areas of grate surface and pound rates of fuel consumption will be of small consequence. The meter measuring the gas will supersede most of the instruments of precision used by the present-day engineers.

J. M. W. KITCHEN, M. D.

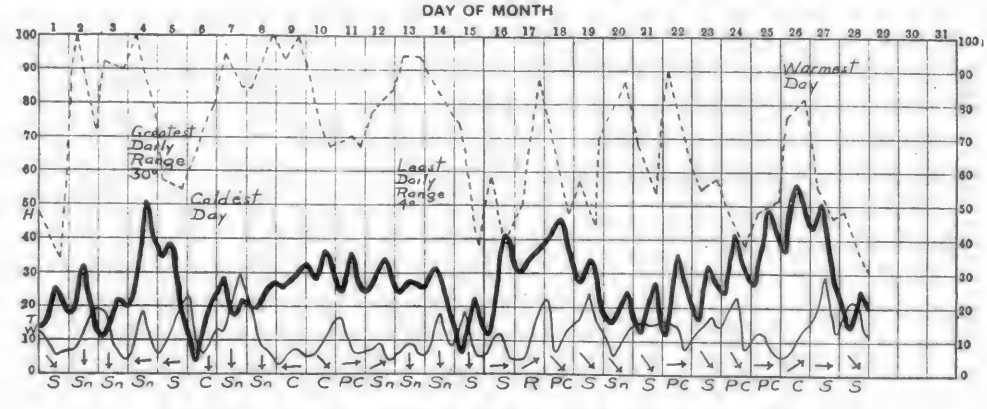
East Orange, N. J.

The Weather for February, 1911

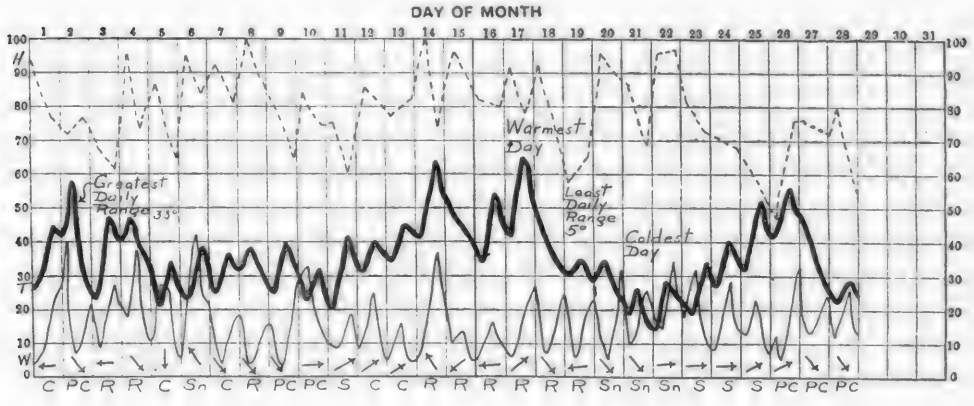
	New York	Boston	Pittsburg	Chicago	St. Louis
Highest temperature, degrees F.	56	56	64	58	84
Date of highest temperature	26	26	17	17	1
Lowest temperature, degrees F.	15	4	14	8	16
Date of lowest temperature	3	6	21	10	22
Greatest daily range, degrees F.	23	30	33	23	40
Date of greatest daily range	3	4	2	17	1
Least daily range, degrees F.	4	4	5	2	6
Date of least daily range	7	13	19	12	12
Mean temperature for month, degrees F.	31	27	35	32	38
Normal mean temp. this month, deg. F.	30.7	28	31.8	25	34
Total rainfall	3.17	2.85	1.98	2.27	3.02
Total snowfall, inches	12.5	19.5	8.6	10.4	13
Normal precipitation, this month, inches	3.74	3.44	2.66	2.16	2.75
Total wind movement, miles	9416	7856	9003	10518	8403
Average hourly wind velocity, miles	14	11.7	13.4	15.7	12.5
Prevailing direction of wind	N. W.	N. W.	N. W.	S. W.	N. W.
Number of clear days	6	9	4	8	10
Number of partly cloudy days	11	5	8	5	7
Number of cloudy days	11	14	16	15	11
Number of days on which rain fell	11	10	13	7	6
Number of days on which snow fell	6	9	4	6	4
Snow on ground at end of month, inches.	None	None	None	None	1.2



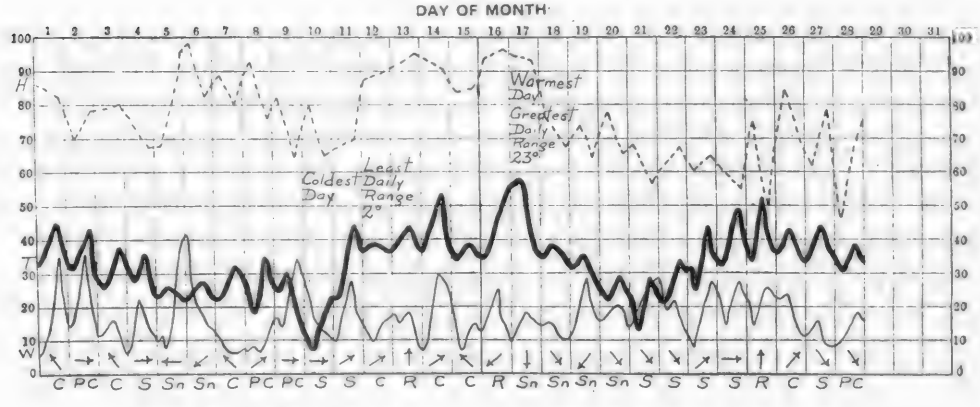
RECORD OF THE WEATHER IN NEW YORK FOR FEBRUARY, 1911



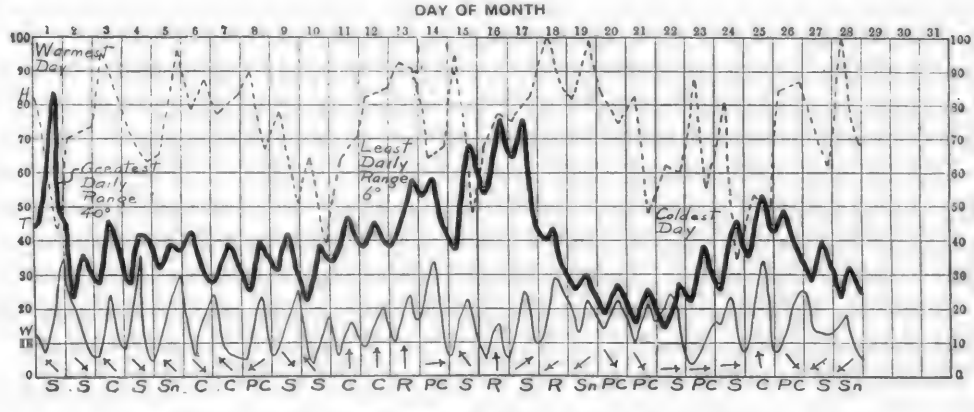
RECORD OF THE WEATHER IN BOSTON FOR FEBRUARY, 1911



RECORD OF THE WEATHER IN PITTSBURG FOR FEBRUARY, 1911



RECORD OF THE WEATHER IN CHICAGO FOR FEBRUARY, 1911



RECORD OF THE WEATHER IN ST. LOUIS FOR FEBRUARY, 1911

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 6 A.M. and 8 P.M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—Snow.
Arrows fly with prevailing direction of wind

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Chicago Gets Next Annual Convention

Official announcement has been made that the next (23rd) annual convention of the National Association of Master Steam and Hot Water Fitters will be held in Chicago. The dates selected are June 5-8, 1911. Headquarters have not yet been announced.

Isolated Power Plant Association

At an organization meeting of the National Isolated Plant Association held in the Engineering Societies Building, New York, the following officers were elected: President, Charles G. Armstrong, New York; vice-president, F. E. Styles, New York; secretary, E. D. Fieux, New York; treasurer, W. B. Elliott, New York; council members (in addition to the president and treasurer) J. C. Buxton, D. D. Kimball, S. F. Ferguson, Henry Katteen, and L. B. Elliman, all of New York. The object of the association as stated in its constitution, which has been adopted, is to foster interests of isolated power plants throughout the United States and the interests of those engaged in the design, construction, operation and ownership thereof. The initiation fee is placed at $25 and annual dues at $25, except for operating engineers, who pay $5 initiation fee and $2 a year dues.

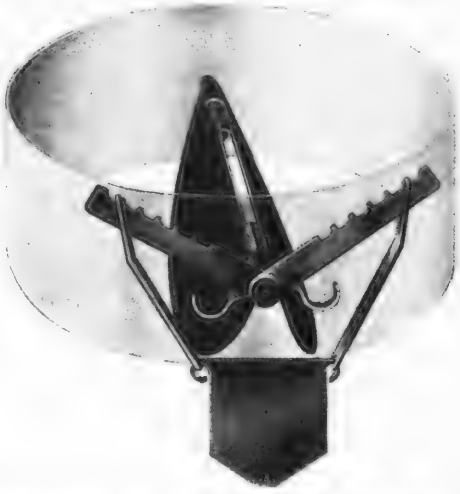
An annual meeting is to be held on the fourth Monday of January and monthly meetings on the last Monday of each month.

NEW DEVICES

A New Fire Governor

A new automatic fire governor for stoves and furnaces, and for which is claimed a saving of from 30 per cent. to 60 per cent. of fuel, anthracite or lignite, has been designed by an engineer of Washington, D. C. The characteristic mechanical feature of the damper is its simplicity, each part, of which there are six, is stamped from sheet metal in sizes suitable for pipes ranging from 5 in. in diameter upwards.

It is operated entirely by the draft, which, as is well known, increases as the heat increases. By its use a fire may be lighted, and without further attention left to control itself. The damper will turn off when the desired temperature is reached or will open the draft, proportionately, should the fire drop a degree or two. In this manner a uniform heat to suit any climate is accurately obtained.

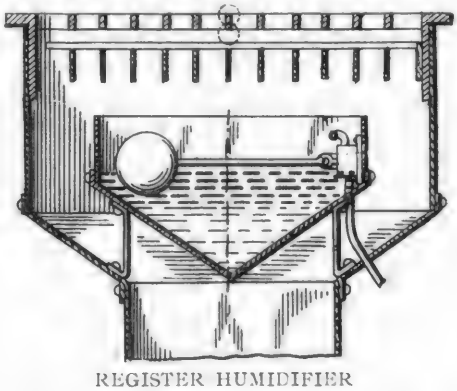


NEW TYPE OF AUTOMATIC FIRE GOVERNOR

The life of the governor is estimated to be about five years. It can be applied to any pipe in a few moments, and in tests has proven practicable. J. V. Robinson of Washington, D. C., is the patentee.

A Register Humidifier

The location of a humidifying device in the casing of a hot air register is a scheme lately patented by George Griffin Lewis, of Syracuse, N. Y., and shown in the accompanying illustration. It will be



REGISTER HUMIDIFIER

noted that a water reservoir, with a downwardly tapered bottom, is placed in the casing which has a corresponding taper, thus permitting an air flow all around the water reservoir. A water supply pipe is connected to the reservoir, bridging the space in the casing. The water level in the reservoir itself is controlled by a float valve.

TRADE AND MISCELLANEOUS NOTES

Coming Events

May 30-June 2, 1911. Spring meeting of The American Society of Mechanical Engineers at Pittsburg, Pa.

June 5-8, 1911. Twenty-third annual convention of the National Association of Master Steam and Hot Water Fitters, at Chicago, Ill.

June 6-8, 1911. Third annual convention of the National District Heating association at Pittsburg, Pa. Headquarters will be at the Fort Pitt Hotel.

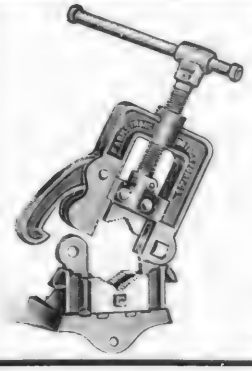
June 13-15, 1911. Annual convention of the National Association of Master Plumbers, Galveston, Texas. Headquarters at the Hotel Galvez.

Deaths

Louis R. Alberger, president of the Alberger Condenser Co., and the Alberger Pump Co., New York, died Jan. 31 at him home in New York. He was 47 years old. Mr. Alberger was for thirteen years superintendent of the condensing department for Henry R. Worthington. He incorporated the Alberger Condenser Co. in 1901. He was one of the best-known specialists in the country in his line. He is succeeded as president by George Q. Palmer, formerly vice-president, while D. H. Chester has been elected vice-president of the Alberger Condenser Co., and W. S. Doran, vice-president of the Alberger Pump Co.

Mrs. A. Fredericka Mueller, widow of the late H. Mueller, founder of the H. Mueller Mfg. Co., Decatur, Ill., died Jan. 26, of cerebral apoplexy, in her 72d year. She is survived by five sons who compose the well-known heating and plumbing manufacturing firm established by their father.

Col. George D. Scott, the first president of the National Association of Master Plumbers, died Feb. 18 at his home in Brooklyn. He was 75 years old.



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No. 1	" "	⅛ " 2½ "	16 "	"
No. 2	" "	¼ " 4½ "	30 "	"
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Miscellaneous Notes

Durham, N. H.—Prof. C. E. Hewitt, of the department of electrical engineering at the State College, has been engaged to report upon the feasibility of the bill introduced by Representative Couch of Concord, which provides for the erection and equipment of a central heat and lighting plant for the State House, state library and the New Hampshire Historical Society building. The bill covers an appropriation of $55,000.

Defiance, O.—An ordinance to grant the Defiance Gas & Electric Co. the right to use the city streets in laying out a central heating system was laid on the table at a recent meeting of the City Council. The company agreed to give heat to the city hall to the amount of $250 a year at the regular rates for such services as a consideration for the franchise.

Minneapolis, Minn.—A central heating plant is being considered by the Greenview Improvement Association, whose district extends from Morgan to Girard Ave. south from Franklin, north to and including Mount Corve. John A. O'Brien is chairman of the committee investigating the subject, the other members being C. Grimsrud and Anton Knoblauch.

Sioux City, Ia.—Plans for a new car heating and cleaning plant for the Northwestern Railroad, to cost several thousand dollars, have been drawn, and it is expected that work will begin soon.

Monticello, Ia.—Work on the new central station heating plant for Monticello will begin in the Spring.

Elgin, Ill.—Plans for a $500,000 stock company to supply the business district of Elgin with steam heat from a central plant have been launched by Henry Muntz of that city. Mr. Muntz has already purchased the old power house at River street and Dexter avenue from the traction company for $10,000.

Baltimore, Md.—The consolidation is reported of the Baltimore Refrigerating and Heating Co. with a number of local ice companies, with an increase in capital stock of $3,000,000.

Anderson, Ind.—An application has been made to the City Council for a franchise for a new steam heating company. It is proposed to surrender the franchise now held by the Home Heating Co. The new franchise will ask for the privilege of covering all territory between the C. W. & M. branch of the Big Four and the Pennsylvania Railroad from east to west and between Sixth and Fourteenth streets from north to south.

Kokomo Railway & Light Co., Kokomo, Ind., has filed notice of enlarge-

We Help Heating and Ventilating Men

to furnish a first-class system by offering them the most powerful gravity ventilator on the market.

In many cases it does away with the necessity of aspirating coils and saves the expense of maintaining power fans. Helps to save money on the heating bill by removing the foul air which is so difficult to heat.

THE "VACUUM" VENTILATOR WILL DO THIS

and at the same time prevent down drafts.

Write for our booklet telling about the principle of the VERTICAL OUTLET.

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Continuous Jointless Pipe Covering
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ment of purpose to enable the company to operate a steam heating plant. G. J. Marott is the president.

Dexter, Ia.—The people of this city will soon vote to determine whether a gas plant shall be installed for heating, cooking and lighting purposes.

Oakland, Cal.—A central heating plant to cost $100,000 is about to be established in Oakland by the Oakland Gas, Light & Heat Co. Work is already under way, the necessary permits having been recently granted by the Oakland Board of Works. The system will cover many of the city's principal streets and will be one of the most important undertakings of its kind in the Far West.

Edward Blake, Jr., until recently manager of sales for Wells Bros. Co., Greenfield, Mass., makers of pipe threading tools, has resigned to take the management of the Canadian Tap Die Co., Ltd., Galt, Ont., of which he has been treasurer since 1905. Mr. Blake holds a controlling interest in the Canadian concern.

Prof. John R. Allen, of Michigan University, has been elected vice-president of the Michigan Engineers' Society, at its recent meeting in Lansing.

Buffalo, N. Y.—On invitation of the Department of Research of the American Radiator Co. a visit was made recently to its testing plant at Buffalo by a committee from the National Association of Master Steam and Hot Water Fitters in connection with its investigation of the question of ratings for house heating boilers. Included in the party were: Vive-president Denny, of Newark, and Messrs. John T. Sadler, John W. Danforth, Gombers, English, Bishop, Baldwin and Cryer of the Standardization Committee.

Cincinnati, O.—Sanitary policemen have been stationed at Fountain Square to see that the street cars are properly ventilated. The suggestions of the health department have been ineffective on some of the city's street lines.

Harrisburg, Pa.—A local association of master steam and hot water fitters has been organized at Harrisburg. At the present writing the new organization is an independent body. President, William Jennings; vice-president, C. Fisher; treasurer, Warren Bossler; secretary, H. B. Low. For the present regular meetings will be held at the plant of the Harrisburg Steam Heat & Power Co.

Richard D. Kimball Co., Boston and New York, heating and ventilating engineers, announces the removal of its

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GLOBE, ANGLE, CHECK, SAFETY, BLOW OFF,

The most practical and economical. Each and every component part is designed to meet the requirements of exacting every day service. In metal and in workmanship care is taken to produce a valve that will give maximum amount of strength and durability.

We shall be glad to mail catalog on request.

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VOL. VII. FOR 1910 NOW READY

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ADDRESS

Heating and Ventilating Magazine, 1123 Broadway, New York

New York offices to 15-17 West 38th street. Its testing and inspection department has been removed to the same address.

Percival Robert Moses, consulting engineer, announces the removal of offices to 366 Fifth avenue, corner of Thirty-fifth street. The Engineering Supervision Company has removed to the same address.

Isolated Plant, New York, announces the removal of its executive offices to 366 Fifth avenue.

American Society of Mechanical Engineers will hold its spring meeting in Pittsburg May 30-June 2, inclusive. The society has not met in that city since 1884. There are now about 160 members in the Pittsburg district. Arrangements for the forthcoming meeting are in the hands of an executive committee consisting of E. M. Herr, George Mesta, J. M. Tate, Jr., Chester B. Albree, D. F. Crawford, Morris Knowles and Elmer K. Hiles, secretary.

United Bunch of Sheep, home fold, at its recent annual meeting in Milwaukee, Wis., elected the following officers for the ensuing year: Grand ram, A. M. Wagner; vice-ram, Richard Hohnbach; grand shearer, George Roska; keeper of the golden fleece, Fred Wagner; shepherd, Arthur Wellhausen; director for one year, U. B. Garnsey; director for three years, F. E. Nolan. Fifty members were in attendance. Plans were reported for organizing branch folds in Minneapolis, St. Paul, Detroit and St. Louis. Although hardly three years old, this unique organization of salesmen has attained a strength, both in numbers and influence.

Springfield, Ill.—At a meeting held recently in Springfield, according to *Domestic Engineering,* a major heating league was formed in conjunction with minor heating leagues already formed in the state of Illinois for the purpose of securing better trade protection for the steam heating contracting trade. T. E. Walters, Aurora, was elected president of the league; J. E. Fitzgerald, Lake Forest, secretary; L. O'Flaherty, Elgin, treasurer; E. C. Barrett, Joliet, and William Hanrahan, Chicago, were made a board of trustees, with power to elect a board of directors.

Master Steam and Hot Water Fitters' Association of San Francisco, Cal., has elected J. G. Sorgen as its president, to succeed F. W. Howard, resigned. The association will send a delegate to the convention of the National Association at Chicago, June 5-8.

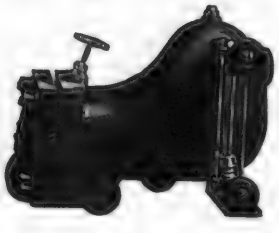
Chicago Steam Heating and Ventilating Engineers held its second annual meeting Feb. 7 at King's Banquet Hall in Chicago. The attendance numbered 74 out of a total membership of 91. The following officers were elected: President, W. B. Graves; vice-president, John O'Shea; treasurer, William Sullivan; secretary, George H. Kirk; directors: Robert Gordon, Charles Glennon and G. F. Schample. E. E. Melum was re-elected recording secretary. Following the

BETTER THAN LEAD

Dixon's Pipe Joint Compound is better and cheaper than red or white lead.
Doesn't "set" joints—goes farther.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J.

McDaniel Improved Steam Trap
WILL DO THE WORK



When you need a Steam Trap buy one you know will work. With a McDANIEL we take all the chances. Don't pay until you are satisfied. We have been 25 years manufacturing Steam Traps and know there is no better trap made. May we send you one for trial?

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160 North 7th Street - PHILADELPHIA, PA.
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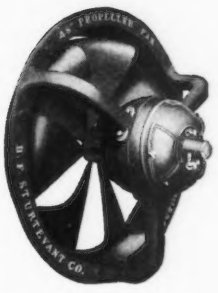
Sturtevant

Propeller Fans for Ventilating and Cooling



The design of our Propeller Fans is along the same scientific lines as all our fan product, and that is why Sturtevant Propeller Fans deliver more air for the same size fan and with less power expenditure than any other propeller type made. The construction is particularly strong and durable.

They will quickly change the air in factories, workrooms, kitchens, billiard halls, etc., carrying away the smoke, fumes, and hot air, keeping the atmosphere sweet and cool.

The electric fans are equipped with motors wound for either alternating or direct current. They may be installed in any position and controlled from any point desired.

Ask for Bulletin No. 146 V

B. F. STURTEVANT CO.

HYDE PARK, MASS. 809

meeting a dinner was served at which the speakers included Robert Gordon, Past President Charles Glennon, George H. Kirk and J. J. Cahill.

Eastern Supply Association held its regular meeting at the Hotel Astor, New York, Feb. 8. In the absence of President P. M. Beecher, the chair was occupied by Vive-President John A. Murray. One hundred members were present. Nine new members were elected, including Bradlee & Chatman Co., Boston; Mayor, Lane & Co., New York, and the United States Radiator Corporation, Dunkirk, N. Y.

Manufacturers' Notes

American Radiator Co., Chicago, will build a warehouse of mill construction at Denver, Colo.

Jenkins Bros., New York, will move into new and larger quarters at 82 White street about the middle of April.

American Blower Co., Detroit, Mich., announces the retirement of C. W. Old as manager of its Atlantic district with headquarters in New York. He is succeeded by Arthur Ritter. Mr. Old will engage in the manufacture of brick. He remains a director of the American Blower Co.

One Heating Plant Does Work of 25

St. Paul's School, at Concord, N. H., consists of 25 buildings, scattered over an area of 2000 acres. Each building was heated by a separate plant until a few years ago, when a central power-plant was installed and the steam carried to the various buildings through pipes installed in J-M Sectional Conduit. This enables them to heat their buildings better, saves the cost of operating 25 separate plants, reduces cost of fuel and cuts down insurance rates.

J-M Sectional Conduit

will carry steam 1000 feet without practically any loss. It saves 90 per cent. of the heat lost in transmission through unprotected or poorly insulated pipes. It can be easily opened up after installation and leaks in pipes readily located. Can be taken up and relaid without injury. Acids, gases or the chemical action of the earth do not affect it. It will last indefinitely.

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Cleveland	Milwaukee	Seattle
Dallas	Minneapolis	St. Louis
	New Orleans	(1234)

Crane Co., Chicago, has increased its capital stock from $13,000,000 to 17,000,000.

Standard Pump & Engine Co., Cleveland, O., has increased its capital stock, having recently purchased the business of the Schletter-Ripple Co., dealers in water supplies. The general sales department is under the management of C. A. Schletter.

American Radiator Company, Chicago, in its annual report, shows net profits of $1,197,517, which are the largest in the company's history. The figures for 1910 were $971,599. Although the common stock was increased from $5,000,000 to $6,150,000 the earnings for the year amounted to 16.05% as compared with 15.23% on the smaller capitalization last year. The sales for the year which resulted in this splendid showing were also the largest the company has reported. A profit-sharing system has been adopted by the company by which its employees may obtain stock on easy payments.

United States Radiator Corporation, Dunkirk, N. Y., announces the appointment of H. M. Anderson as assistant manager of its Omaha branch. This branch is under the direct management of Fred R. Bishop. The corporation's branch in Baltimore, Md., is now located at 709 North Howard street, where a new show room has been opened with Joshua Naylor in charge. The Philadelphia office has been moved from the Drexel Building to 122 North 13th street, where an elaborate display of the company's line of boilers and radiators is to be seen in charge of George W. Barr, the new manager of the Philadelphia branch.

Kennedy Valve Mfg. Co., Elmira, N. Y., has appointed F. K. Russell as its special representative in Philadelphia and vicinity. Mr. Russell has been connected with Crane Co. for the past seventeen years in its Philadelphia office.

New Incorporations

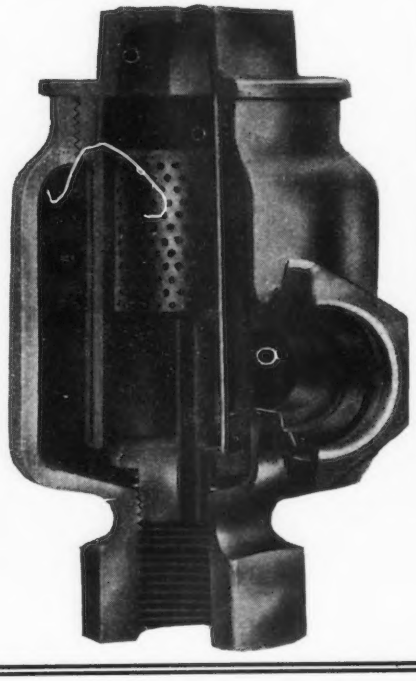
Martels Water Heater Co., St. Louis, Mo. Capital, $10.000. Incorporators: Chas. von Martels, H. W. Martels and J. E. Diamond.

Kollker Electric Co., Evansville, Ind. Capital, 10,000. To buy and sell heating, plumbing and electrical supplies. Incorporators: Henry Kollker, Jr., Amelia Kollker and C. Kollker.

Potts-Rine Supply Co., Columbus, O. Capital, $25,000. To take over heating and plumbing supply business of B. D. Potts. Incorporators: B. D. Potts, Frank Short, L. G. Williams, Harry L. Potts, and Frank M. Rine, formerly pur-

THE VALVE THAT HAS MADE GOOD

89 Mowell Automatic Relief Valves are installed in the Doherty Silk Mill, in Paterson, one of the most up-to-date plants in the country and THE SYSTEM WORKS PERFECTLY



Send for descriptive matter, telling how the Mowell Automatic Relief Valve is suited to Exhaust and Low Pressure Steam Heating, how it expels all air and water from the radiator and how easy it is to keep clean.

Augustus Mowell
249 Graham Avenue, PATERSON, N. J.

chasing agent for the Westwater Supply Co., of Columbus.

Columbus Supply Co., Columbus, O. Capital, $30,000. To deal in steam, gas and plumbing supplies. Incorporators: Frederick M. Abbott, Joseph Falkenbach, William L. Stehle, Harry H. Young and George Link.

Morrin Climax Boiler Co., Jersey City, N. J. Capital, $100,000. To manufacture boilers, steam generators, fittings, etc. Incorporators: T. F. Morrin, E. T. Morrin and Mr. O'Day. The company has purchased the plant of the West Pulverizing Machine Co., at Mallory and Pollock avenues, Jersey City.

Geo. A. Weld Co., 79 Milk street, Boston. Capital, $10,000. To deal in steam and hot water specialties. Incorporators: R. Linscott, president; George A. Weld, treasurer, and D. C. Linscott.

Atwood Vacuum Cleaner Co., Rockford, Ill. Capital, $50,000. To make stationary vacuum cleaners.

American Rotary Valve Co., Chicago. Capital, $500,000. To manufacture vacuum cleaners and a rotary valve. The company's headquarters will be located at 56 Dearborn street. President, William Waller; vice-president, D. Smith; secretary, Austin H. Hart; treasurer, Warren C. Fairbanks; assistant treasurer, William Waller, Jr.

Knapp Boiler Co., Minneapolis, Minn. Capital, $350,000. To take over the business of the Knapp Boiler Works. The company makes a sectional water-tube boiler for heating work.

American Heating & Supply Co., Rockford, Ill. Capital, $40,000. To engage in the manufacture of heating plants. Incorporators: Fred K. Houston, Merritt H. Mott, Harry S. Vandenberg and Charles Franz.

W. S. Hannum Plumbing & Heating Co., Danville, Ill. Capital, $20,000. To take over heating and plumbing business of W. S. Hannum & Co. Incorporators: Walter S. Hannum, Albert Hannum and William Halbert.

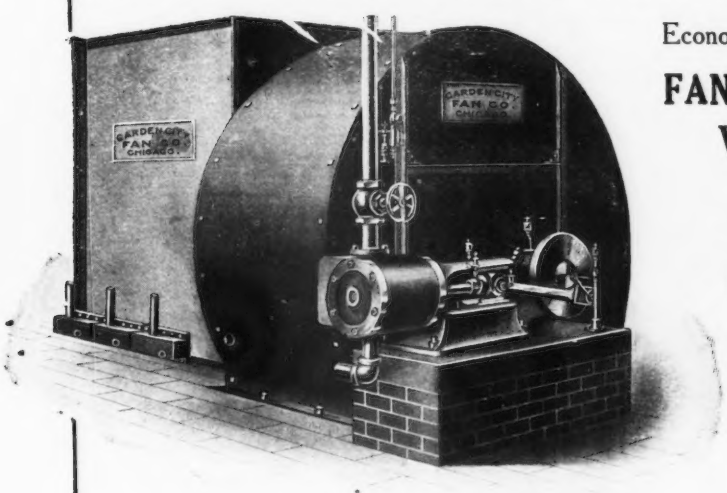
Metropolis Heater & Appliance Co., New York. Capital, $25,000. Incorporators: T. La Var, H. A. Archibald and R. W. Booker, all of New Rochelle, N. Y.

America Heating & Supply Co., Rockford, Ill., capital $40,000, fully paid up, is the title of a new corporation formed to take over the business of the America Heating Co. and also to conduct a general jobbing business in heating and engineers' supplies. The company will greatly enlarge the operations of the former firm in the contracting and installation of heating and ventilating systems. Incorporators: F. K. Houston, M. H. Mott, Charles Frans and H. S. Van Denberg, all of whom have been active in the former company under Mr. Houston. The officers of the new company are: President, F. K. Houston; vice-president, M. H. Mott; secretary and treasurer. H. S. Van Denberg; general superintendent, Charles Frans.

American Heating and Ventilating Co., Cleveland, O.; capital $10,000. Incorporators: Chas. L. Sobotta, T. M. Golden, Lena G. Moulder, Albert W. Moulder and Carrie C. Sobotta.

Plant Equipment Co., Cleveland, O.;

HEATING APPARATUS THAT MAKES GOOD



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Garden City Fan Co.
McCormick Building
Chicago Illinois

New York Office
Singer Building
149 Broadway

capital $10,000, to make and install heating and power plants. Incorporators: Charles Eisele, A. D. Dickson, S. E. Manix, E. W. Kraft and J. F. Patterson.

Winterbottom Construction Co., Cleveland , O., capital $10,000, to conduct heating and ventilating business and to do construction work. Incorporators: Joseph and Minnie Winterbottom, Edwin S. Dickerson, John H. Haas and Chas. B. Benz.

Wilkinson Foundry & Mfg. Co., Bridgeport, Pa., capital $200,000, to take over the business of the Wilkinson Foundry Co. and Lorenna Foundry Co., of Bridgeport, Pa., and the Stroud-Wilfong Co., of Philadelphia. The company will make feed water purifiers and other heating specialties. President, Benjamin F. Evans; vice-president, C. S. Wilfong; secretary and treasurer, Joseph C. Lorenna.

Warneke-Deringer Co., Minneapolis, Minn., organized to conduct a jobbing business in heating and plumbing supplies. The members of the firm are Hermann, J. Warneke and George H. Deringer.

Flectropic Products Co., Buffalo, N. Y., organized to manufacture radiators. The company will build a fire-proof factory at Elmwood and Hertel avenues.

Ideal Pump Co., Denver, Colo., capital $25,000. Incorporators: J. T. Moynahan, T. J. Moynahan and Wm. Wahl.

Scott & Co., Philadelphia, capital $100,000, to conduct a heating contracting business. Incorporators: David E. Rattan and Oliver E. Solomon, of Philadelphia, and James Lord, of Dover, Del.

Untereiner Heating Co., Jersey City, N. J., capital $15,000, to deal in heating and plumbing supplies.

Hankinson Plumbing & Heating Co., Hankinson, N. D., to conduct heating and plumbing contracting business, taking over the business of John Green. The manager of the new firm is C. C. Putnam.

José Heating Co., Portland, Me., capital $10,000, to maintain a steam heating and power plant in that city. President, John C. Small; treasurer, Richard Webbs.

Knox Terpezone Co., Elizabeth, N. J., capital $250,000, to manufacture heating and ventilating appliances with special reference to hospital. Incorporators: William J. Knox, Lewis H. Rogers and W. A. Sherman.

Spencer & Haviland, 174-176 South Portland avenue, Brooklyn, N. Y., have failed with liabilities amounting to $43,400. The firm is one of the oldest supply houses in the East, having been establishe for nearly forty years.

Business Changes

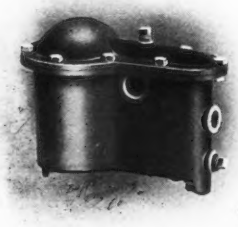
Limbert-Smith Plumbing Co., Akron, O., has increased its capital stock from $10,000 to $25,000. The officers of this enterprising concern are: President, J. D. Slater; secretary, B. G. Smith.

Ideal Heating Co., Columbus, O., has increased its capital stock from $10,000 to $25,000. The company manufactures gas furnaces and fittings. President, Samuel Fippin; secretary, F. C. Medick; general manager, R. S. Thompson; mechanician, O. L. Skinner; business manager, R. A. Magley.

Wanted

Wanted, foreman of sheet metal shop for large heating and ventilating firm on Pacific Coast. Must thoroughly understand the business and have good executive ability. $1,700 salary to first-class, capable man. Give name, age, references, and experience. Address, Ventilating, care HEATING AND VENTILATING MAGAZINE.

Heating and Ventilating Engineer, with eleven years' experience, desires to represent live lines connected with the heating and ventilating field in Chicago and surrounding territory on a commission basis. Thoroughly versed in hot-blast engineering. Desires line of asbestos or magnesia products. Ample warehouse facilities for stock. Address, Chicago, care of HEATING AND VENTILATING MAGAZINE.



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The trap question will be settled if you install an EMPIRE. Adapted to all classes of low pressure work. Perfectly automatic in operation. THE SIMPLEST TRAP MADE. Let us send you one on trial. You will be surprised at its low cost too.

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LOCKPORT, N Y. **CHICAGO, ILL.**